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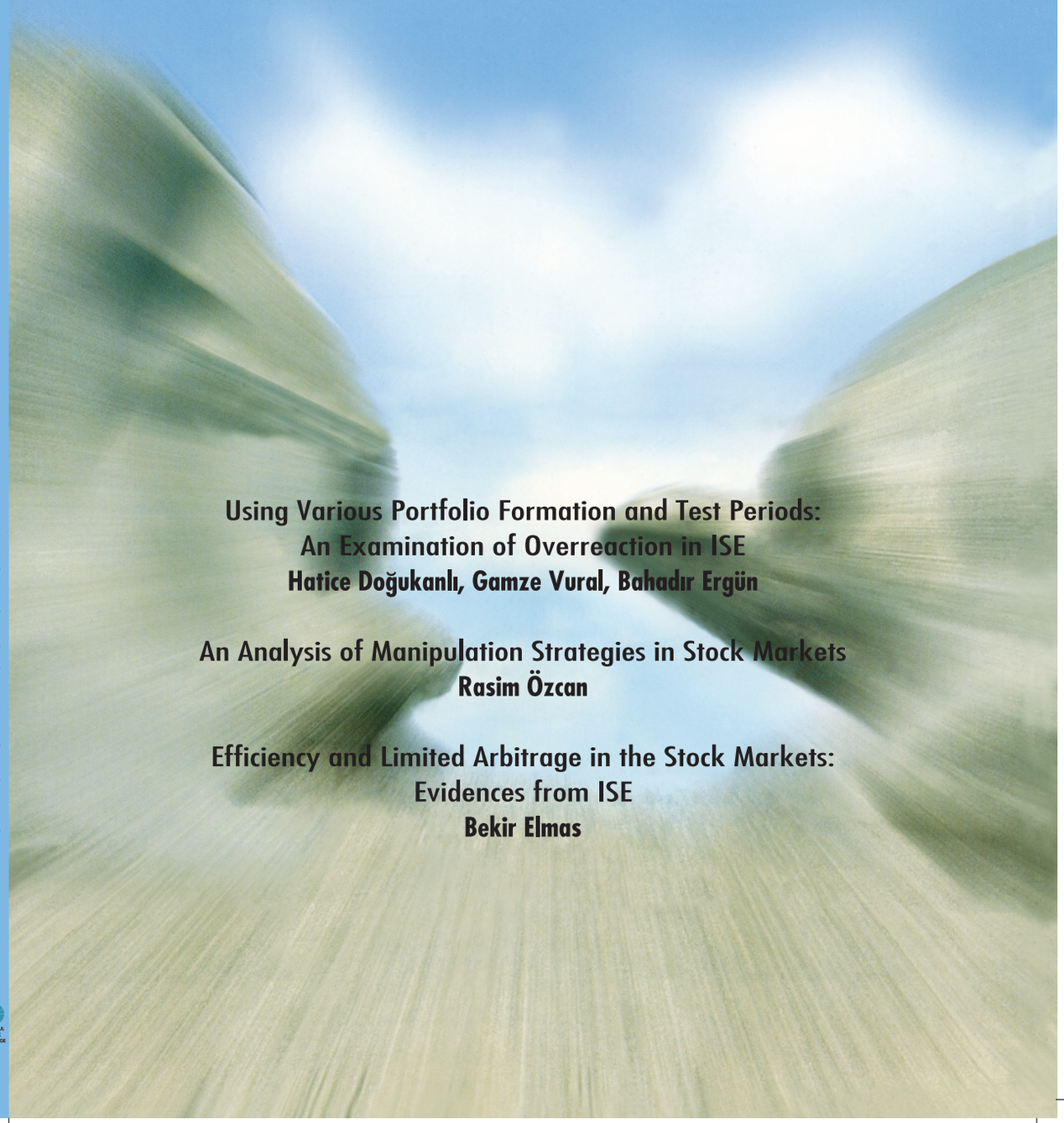

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Address of Administration: İMKB, Istanbul Stock Exchange, Reşitpaşa Mah. Tuncay Artun Cd. Emirgan 34467, Istanbul / TURKEY
Contact Address: İMKB (ISE), Research Department,
Reşitpaşa Mah. Tuncay Artun Cd. Emirgan 34467, Istanbul / TURKEY
Phone: (0212) 298 21 00 Fax: (0212) 298 25 00
Web site: http://www.ise.org
E-mail: evren.arik@imkb.gov.tr, elif.mutlu@imkb.gov.tr

Objectives and Contents

The ISE Review is a journal published quarterly by the Istanbul Stock Exchange (ISE). Theoretical and empirical articles examining primarily the capital markets and securities exchanges as well as economics, money, banking and other financial subjects constitute the scope of this journal.

Copy Guides for Authors

Articles sent to the ISE Review will be published after the examination of the Managing editor and the subsequent approval of the Editorial Board. Standard conditions that the articles should meet for publication are as follows:

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8. References to personalities in the text should be entered as: Smith (1971) or (Smith, 1971); two authors: Smith and Mill (1965) or (Smith and Mill, 1965); three or more authors: Smith et al. (1974) or (Smith et al.,1974). References to papers by the same author(s) in the same year are distinguished by the letters a,b,c, etc. (e.g. Smith, 1974a). References should be listed at the end of the paper in alphabetical order.
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   - -Articles:
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USING VARIOUS PORTFOLIO FORMATION AND TEST PERIODS: AN EXAMINATION OF OVERREACTION IN ISE

Hatice DOĞUKANLI[*]
Gamze VURAL[**]
Bahadır ERGÜN[***]

Abstract
In this paper whether the Overreaction Hypothesis was valid and the contrarian investment strategies were useful to earn supernormal returns with different time horizons, were examined in Istanbul Stock Exchange (ISE). These forenamed time horizons were 1, 2, 3, 6, 12, 24 and 36-month periods. The examination was performed through a modified version of the method of DeBondt and Thaler (1985) with overlapping periods. In conclusion of the analysis, results supporting Overreaction Hypothesis and effectiveness of the contrarian strategies were found in most of the portfolio formation and test periods. This may indicate that ISE is not weak form efficient.

Keywords: Efficient Markets Hypothesis, Behavioral Finance, Overreaction Hypothesis, ISE.
JEL Classification: G14

I. Introduction

Pursuant to the Efficient Markets Hypothesis (EMH), the prices reflect all the accessible information (Fama, 1970, p.383). Since the investors are rational, the stocks are correctly priced. The new coming information is reflected to the prices without causing any under or over reaction. If a deviation occurs from the

[*] Hatice DOĞUKANLI, Professor, Çukurova University, Faculty of Economics and Administrative Sciences, Department of Business Administration, Balcalı/ADANA. Phone: 0312 3387254-60/196, 3608/196 E-mail: hatdog@cu.edu.tr

[**] Gamze VURAL, Assistant Professor, Çukurova University, Faculty of Economics and Administrative Sciences, Department of Business Administration, Balcalı/ADANA. Phone: 0312 3387254-60/275, 3608/275 E-mail: gvural@mail.cu.edu.tr

[***] Bahadır ERGÜN, Research Assistant, Osmaniye Korkut Ata University, Faculty of Economics and Administrative Sciences, Department of Business Administration, Karacaoğlan Yerleşkesi, Merkez/OSMANİYE. Phone: 0328 8251818, 3040 E-mail: bahadirergun@oku.edu.tr

essential values, arbitrage takes place quickly and corrects the prices. Hence, getting abnormal profits in the efficient markets is not possible.

There are three different aspects of market efficiency. These are allocational, functional and informational efficiencies. However, generally the informational one is meant by the market efficiency. It is very rare and short termed to be a difference between actual and market values because of the rational investors. They terminate this difference with their rational decision making.

There are three different forms of efficient markets. First one is weak form efficient markets which reflect all the past information in the prices. Other one is semi-strong form efficient markets. In this type, the prices consist of all the past and publicly available information. The last one is strong form efficient markets which contain all kinds of information.

On the other hand the investors may not be rational every time owing to the psychological facts according to the Behavioral Finance approach. As the investors may be irrational, stocks may be mispriced. Although the EMH says it is not possible to predict the future movements of the prices, Behavioral Finance argues that it is possible to predict and earn abnormal returns through taking appropriate positions in the capital markets.

In contrast with the EMH, the basis of the Behavioral Finance is the investors' behaviors. Behavioral Finance uses the science of psychology in order to analyze deviations from the rational behavior. In line with that intuition, beliefs or cognitive models are taken into consideration.

One of the studies that refuse the EMH is the study of Shiller (1981). According to the researcher, the fluctuations in the stock market cannot be explained by only the new coming information. The study of DeBondt and Thaler (1985) is another example which will be elaborated on later.

If an empirical observation cannot be explained through the theoretical basis, this is an anomaly (Thaler, 1987a, p. 169). The theoretical basis addresses the EMH here. Anomalies can be separated as calendar anomalies, firm anomalies and price anomalies where the overreaction anomaly is a subtitle of price anomalies. If an anomaly is noticed by the investors, they can take position to get abnormal returns in contrast with the EMH. In other words, in the EMH the returns should not be predictable. In this study the Overreaction Hypothesis was tested in ISE to see the differences of the overreaction of the portfolios that have different (1, 2, 3, 6, 12, 24 and 36-month periods) formation and test lengths.

II. Literature Review

Two of the studies criticizing the EMH were held by DeBondt and Thaler (1985, 1987). They used data of 1933-1980 period and explored the efficiency of New York Stock Exchange (NYSE). The findings were contrary to the EMH and the authors announced this was a new kind of anomaly. DeBondt and Thaler (1985, 1987) named 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). In their methodology, DeBondt and Thaler (1985), for each stock they calculated the cumulative abnormal returns for the portfolio formation periods (36 months). The cumulative excess returns were listed from low to high and portfolios were formed. Firms in the top 35 stocks were embedded into the winner portfolio, and the firms in the bottom 35 stocks into the loser portfolio. Then, they calculated the cumulative average abnormal returns of all securities in the portfolio for the subsequent (test) period. The findings proved that loser portfolios outperformed the market. Winner portfolios earned less than the market. Another notable finding was that the overreaction effect was asymmetric; it was much larger for losers than winners.

Seyhun (1990) studied the overreaction by using a period which contains 1987 U.S. Stock Market Crash. He stated that investors may overreact more in times of crash. He also indicated that this overreaction may have a magnifying effect to the crashes. Lehmann (1990) examined the Overreaction Hypothesis in NYSE and AMEX (American Stock Exchange) using the weekly data of the 1982-1986 period, and found strong evidence. According to the findings, it was possible to earn abnormal returns with the help of the contrarian strategies. Bremer and Sweeney (1991) proved that the price reversals of 10-day extreme stock price decreases reached their fundamental values in 2 days. Moreover, they claimed this event was discrete than the other anomalies. Chopra, Lakonishok and Ritter (1992) reanalyzed the findings of DeBondt and Thaler. In the 1926-1986 period, they investigated the stock returns in NYSE, their incorporate size, prior returns, and betas. They found that loser portfolios formed on the basis of prior 5-year returns outperformed winners by 5 to 10 percent per year during the

subsequent 5 years. Furthermore, the authors observed that for the period of January and for the smaller firms, larger arbitrage portfolio returns were available (Yücel and Taşkın, 2007, p.29). Liang and Mullineaux (1994) analyzed the price movements before and after the unexpected information, and they pointed out overreaction in the short-run, as well.

Clare and Thomas (1995) noted that the performance of the previous loser stocks were better than the previous winner stocks in the test periods covering the period from 1955 to 1990 in the U.K. Bowman and Iverson (1998) examined the Overreaction Hypothesis in the stock market of New Zealand using the weekly data and presented their proofs, supporting the hypothesis. They indicated that the losers overreacted more than the winners. Namely, investors overreacted more to the bad news. Fung (1999) pointed out that in Hong Kong Heng Seng Index, previous losers tended to outperform previous winners by 9,9% in the one-year test period.

Dreman and Lufkin (2000) argued the reason of the large scaled increases and declines of the stock prices is the overreaction in the portfolio formation period. Nam, Pyun and Avard (2001) observed overreaction in the NYSE, AMEX and NASDAQ in 1926-1997 period. They also indicated that the price reversals were asymmetric. Ahmad and Hussain (2001) proved the long term overreaction and the effectiveness of the contrarian strategies in their study, carried out in Malaysia's Kuala Lumpur Stock Exchange during 1986-1996. Ülkü (2001) confirmed overreaction in Istanbul Stock Exchange-100 Index (ISE-100) between 1989 and 2000, using the monthly returns (Barak, 2006, p. 164). Durukan (2004) made a study to search the long-term overreaction in ISE. Within the 1988-2003 period of time, the findings put forward that the Overreaction Hypothesis was valid. In other words, the returns of the loser portfolios in the test periods were higher than the returns of the winner portfolios.

Chen and Zhu (2005) asserted that the investors overreacted to the bad news whereas they underreacted to the good news in their study which used daily data of the 1997-2005 period on Shanghai Composite Index. Antoniou, Galaritos and Syprou (2005) investigated whether the contrarian profits were available in the Athens Stock Exchange (ASE). They reached results supportive of the Overreaction Hypothesis between 1990 and 2000 in ASE General Price Index. Öncü, Aktaş, Kargın, Aktaş and Kayalı (2006) suggested that findings were parallel to the Overraction Hypothesis in their study investigating the reaction of the investors to the important price movements. They presented that the investors

overreacted to the information that is unexpected and incoming between the closing and opening hours of the stock market in the first hours. However, after a while they notice that failure and subsequently the price reversals appear. Yücel and Taşkın (2007) tested the validity of the Overreaction Hypothesis in the period of 1992-2005 in ISE. The findings confirm that winner and loser portfolios based on prior returns provide excess subsequent returns, which supports the hypothesis. Ergün (2009) tested the validity of the Overreaction Hypothesis and whether the contrarian investment strategy is useful to earn supernormal returns in five different indexes of ISE (ISE 100, ISE 50, ISE 30, ISE Financial and ISE Industrial) between July 1998 and June 2008 using the monthly returns. In conclusion of the analysis, proofs which support Overreaction Hypothesis and the effectiveness of the contrarian strategies were found in all indexes except ISE 30 Index.

III. Methodology

The method of DeBondt and Thaler (1985) is initial and commonly used test to investigate overreaction in stock markets. In this study the method was modified and 1, 2, 3, 6, 12 and 36-month portfolio formation and test periods were created. In order to increase the number of observations and statistical significance Ritter and Loughran (1996) and Baytas and Cakici (1999)'s methodology was adopted and overlapping periods were taken as separate formation and test periods (Taşkın, 2006, p. 78). In this methodology there are portfolio formation and test periods. The portfolios are generated according the performance of the stocks in the formation periods, and then in the test periods, the performances of these portfolios are investigated whether they confirm the Overreaction Hypothesis. In other words, at first the abnormal returns and cumulative abnormal returns with respect to the forestated portfolio formation-test period number for each stock are calculated. Since the overlapping periods are used in this study, the beginning and ending dates of the formation period, for instance for the portfolios that have 6-months formation-test periods, are July 1998 and December 1998; and the test period is between January 1999 and June 1999. For the second portfolio, the formation is in the August 1998- January 1999 period; however, the test is in the February 1999- July 1999 period. Considering these returns for each formation period, the best and worst performed stocks are chosen to create the winner and loser portfolios. The vital point here is to see

whether the loser portfolios outperform the market and the winner portfolios earn less than the market in the subsequent (test) periods.

The monthly returns of the stocks which were traded continuously in ISE 100, between July 1998 and December 2008 were chosen as the sample. Adjusted monthly returns of all stocks were obtained from the web site of ISE.

So as to find the excess returns of the stocks the following formula was used. Where ($AR_{i,t}$) stands for the abnormal return of the stock i for month t, ($R_{i,t}$) is the return of the stock i for the month t, and ($R_{m,t}$) is the market return:

$$AR_{i,t} = R_{i,t} - R_{m,t} \tag{1}$$

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

$$CAR_i = \sum_{t}^{0} AR_{i,t} \tag{2}$$

The stocks are ranked according to their CAR_i values. The winner and loser portfolios were formed with the best 10 % and worst 10 % performed stocks. In the portfolios, the stocks have equal weights.

For the test periods for each month t, the cumulative abnormal return for the portfolio is calculated by using the formula below. Where 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.

$$CAR_{p,z,t} = \sum_{t}\left[(1/N)\sum_{i=1}^{N} AR_{i,t}\right] \tag{3}$$

For the loser and winner portfolios the average cumulative abnormal return is calculated for each month for the test months with the formula:

$$ACAR_{p,t} = \frac{\sum_{z=1}^{Z} CAR_{p,z,t}}{Z} \tag{4}$$

Eventually one can claim the overreaction in the stock market, if $ACAR_{W,t}<0$ and $ACAR_{L,t}>0$, or $[ACAR_{L,t} - ACAR_{W,t}] >0$.

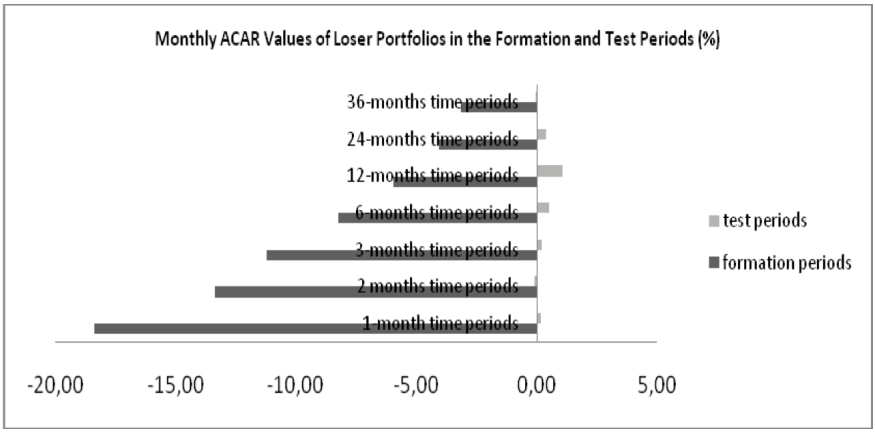
IV. Results

The analysis, explained in the methodology part of the paper, was implemented to the various portfolio formation and test periods. The results supported the overreaction literature; however, there are some exceptions.

Table 4.1: Monthly ACAR Values of Loser and Winner Portfolios in the Formation and Test Periods (%)

	LOSER PORTFOLIO (L)				WINNER PORTFOLIO (W)			
	formation period		test period		formation period		test period	
	CAR p	ACAR p,t	CAR p	ACAR p,t	CAR p	ACAR p,t	CAR p	ACAR p,t
1-month time periods	-18,40	-18,40	0,17	0,17	27,73	27,73	-0,11	-0,11
2-month time periods	-26,80	-13,40	-0,19	-0,09	39,38	19,69	1,04	0,52
3-month time periods	-33,69	-11,23	0,59	0,20	48,50	16,17	0,52	0,17
6-month time periods	-49,49	-8,25	2,96	0,49	69,01	11,50	-2,58	-0,43
12-month time periods	-71,47	-5,96	12,67	1,06	95,45	7,95	-7,10	-0,59
24-month time periods	-97,90	-4,08	9,59	0,40	131,18	5,47	-14,43	-0,60
36-month time periods	-112,81	-3,13	-1,70	-0,05	151,11	4,20	-19,03	-0,53

Figure 4.1: Monthly ACAR Values of Loser and Winner Portfolios in the Formation and Test Periods (%)



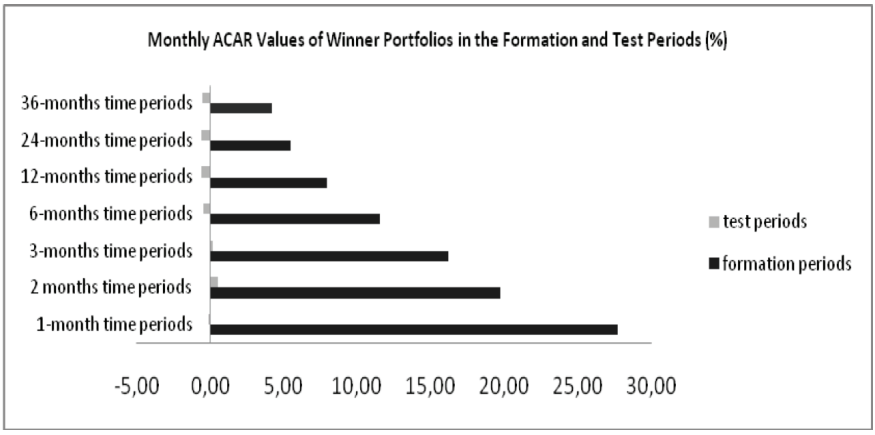


Table 4.1 and Figure 4.1 show the monthly ACAR values, observed in the various portfolio formation and test periods for both the loser and winner portfolios. The important thing is to see the behaviors of the chosen portfolios in the formation and test periods. In parallel with the Overreaction Hypothesis, the portfolios which were created with the combination of the worst performing stocks, performed better in the test periods; besides the portfolios which were created with the best performing ones, performed worse. For example, while the loser portfolios which were created with 12-months formation and test periods had -5,96% cumulative abnormal return in the formation periods, they subsequently had 1,06% in the test periods. For the winner portfolios this return was 7,95% in the formation periods and -0,59% in the test periods. In this circumstance, two conditions of the Overreaction Hypothesis ($ACARW,t<0$ and $ACARL,t>0$) were met. In the light of these findings it can be easily figured out that all time periods met the conditions of Overreaction Hypothesis ($ACAR_{W,t}<0$ and $ACAR_{L,t}>0$) out of the 2-month time periods in the loser portfolios and both 2 and 3-month time periods in the winner portfolios.

The time points displayed in the graphs show not only the beginning of the formation periods but also the test periods. That is to say, for the 1-month periods, Jul-98 means the first month (formation) and also the second month (test), to give an example.

Table 4.2: $ACAR_L$-$ACAR_W$ (%)

formation/test periods	$ACAR_L$-$ACAR_W$
1-month time periods	0,28
2-month time periods	-0,61
3-month time periods	0,03
6-month time periods	0,92
12-month time periods	1,65
24-month time periods	1,00
36-month time periods	0,48

Figure 4.2: $ACAR_L$-ACARW (%)

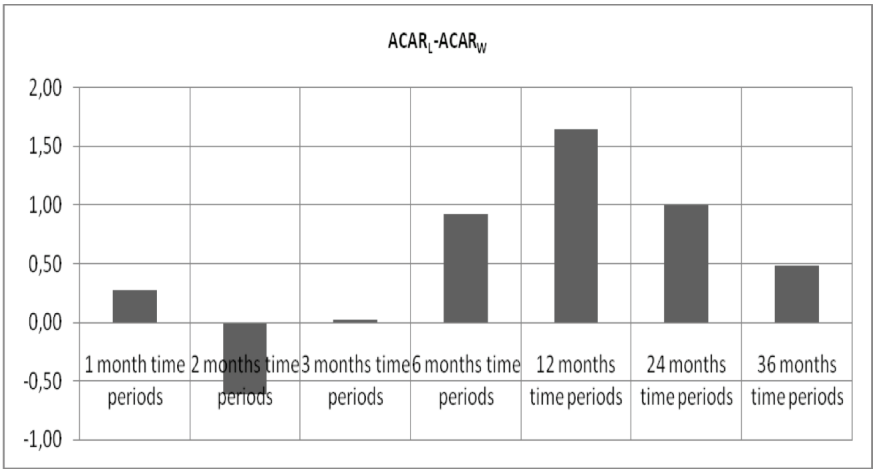
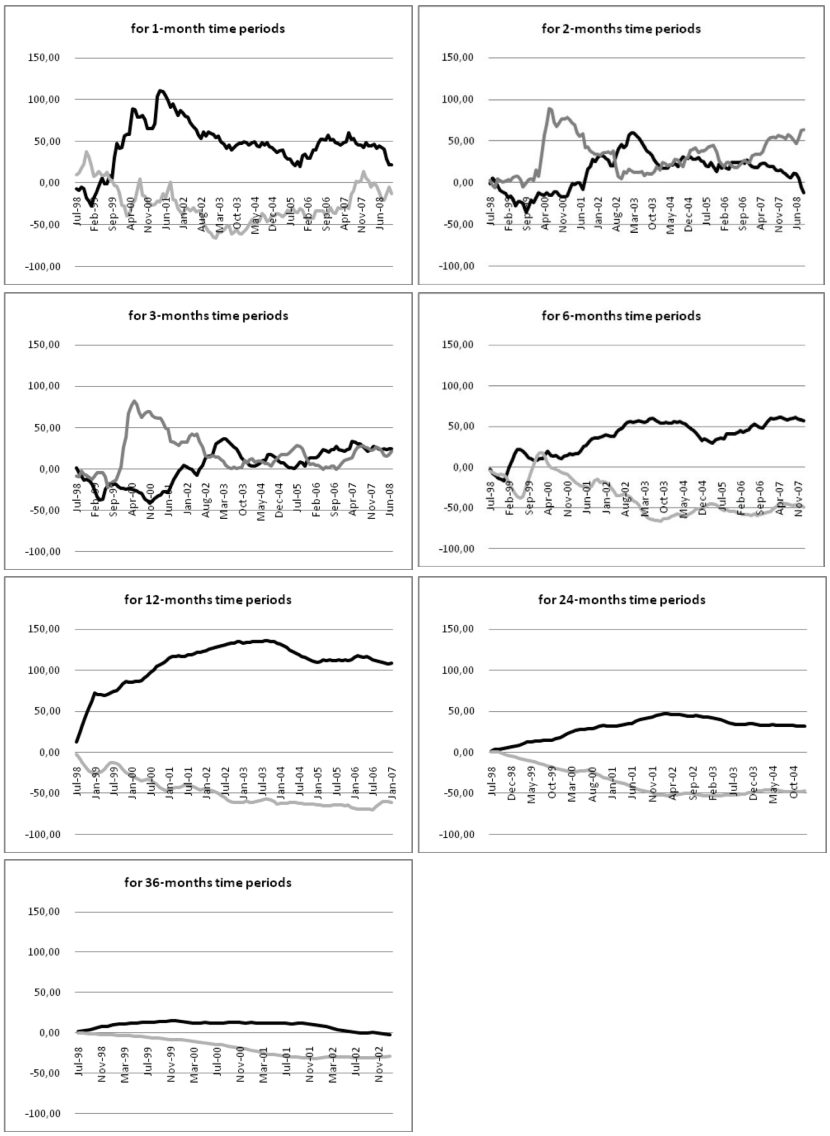


Table 4.2 and Figure 4.2 indicate whether the portfolios of the different time periods met the last condition of the Overreaction Hypothesis ($[ACAR_{L,t} - ACAR_{W,t}] >0$). In addition, the table and figure also show whether the strategy that the hypothesis advices, "buy the losers and sell the winners of prior periods" (contrarian strategies) was useful to earn abnormal returns or not. If the residuals are positive, this means the contrarian strategies are useful. In accordance with the results, portfolios of 2-month time periods contradicted with the overreaction condition. In addition, the biggest overreaction can be observed in the 12-month periods.

Figure 4.3: Cumulative ACAR Values in Test Periods (%)

(loser portfolio winner portfolio)



Cumulative ACAR values in test periods are salutary to investigate whether the strategies relevant to the Overreaction Hypothesis were useful to earn supernormal returns during the periods. Figure-4.3. can show this visually. The

spirals seen in the 2 and 3-month time periods mean this did not work. However, especially as in 12-month periods, if the distance between the lines gets bigger (loser should be above), this means if one observes the price behaviors of the stock for 12-month and chooses loser and winner portfolios, then if this person realizes the portfolios, he or she wins more.

Table 4.3: Price Reversals

formation/test periods	|ACARL| (%)	|ACARW| (%)	residual
1-month time periods	0,17	0,11	0,07
2-month time periods	0,09	0,52	-0,43
3-month time periods	0,20	0,17	0,03
6-month time periods	0,49	0,43	0,06
12-month time periods	1,06	0,59	0,46
24-month time periods	0,40	0,60	-0,20
36-month time periods	0,05	0,53	-0,48

Price reversals are important because in the light of these, how much the investors overreacted in the formation period can be figured out. If the residual of the $|ACAR_L|$ and $|ACAR_W|$ is positive, this means investors had overreacted to the bad news more than the good news, which is parallel to the literature. In Table-4.3 some negative values can also be seen; however, especially in the 12-month time periods, investors overreacted more to the bad news.

Table 4.4: t-test results

length of the period	portfolio / period	mean	t	sig (2 tailed)
1-month	loser / formation	-18,4	-20,3	0,000
	loser / test	0,17		
	winner / formation	27,73	21,75	0,000
	winner / test	-0,1		
2-month	loser / formation	-13,4	-21,82	0,000
	loser / test	-0,09		
	winner / formation	19,69	21,65	0,000
	winner / test	0,52		
3-month	loser / formation	-11,23	-23,33	0,000
	loser / test	0,2		
	winner / formation	16,17	21,57	0,000
	winner / test	0,17		
6-month	loser / formation	-8,25	-23,46	0,000
	loser / test	0,49		
	winner / formation	11,5	24,01	0,000
	winner / test	-0,43		
12-month	loser / formation	-5,96	-20,44	0,000
	loser / test	1,06		
	winner / formation	7,95	25,05	0,000
	winner / test	-0,59		
24-month	loser / formation	-4,08	-31,72	0,000
	loser / test	0,4		
	winner / formation	5,47	29,1	0,000
	winner / test	-0,6		
36-month	loser / formation	-3,13	-21,25	0,000
	loser / test	-0,05		
	winner / formation	4,2	29,34	0,000
	winner / test	-0,53		

t-test was implemented to see whether there was a significant difference between the ACAR values of formation and test periods. The results are given in Table 4.4 and test shows us the significant difference exists.

V. Conclusion

The paper investigated the Overreaction Hypothesis in ISE 100 index through various portfolio formation and test periods. The method of DeBondt and Thaler (1985) was modified and created 1, 2, 3, 6, 12 and 36-month portfolio formation and test periods. In addition, Ritter and Loughran (1996) and Baytas and Cakici (1999)'s methodology was implemented, and overlapping periods were taken as

separate formation and test periods (Taşkın, 2006, p. 78). The monthly adjusted returns of the stocks, traded continuously in ISE 100 in the July 1998-December 2008 period, were used.

Consequently, all time periods met the conditions of Overreaction Hypothesis ($ACAR_{W,t}<0$ and $ACAR_{L,t}>0$) out of the 2-month time periods in the loser portfolios and both 2 and 3-month time periods in the winner portfolios. The other condition of the hypothesis ($[ACAR_{L,t}-ACAR_{W,t}]>0$) was not satisfied only by the 2-month time periods. Then, the biggest overreaction was observed in the 12-month periods. Finally, it was figured out investors overreacted to the bad news especially in the 12-month periods.

The paper showed the behaviors of the investors and some clues to earn supernormal returns for the various portfolio periods. In the analyzed period especially the investors who took position that the Overreaction Hypothesis advises and who had 12 month time horizon, earned more supernormal returns.

References

Ahmad, Z., & Hussain, S. (2001). KLSE Long-Run Overreaction and the Chinese New Year Effect. *Journal of Business Finance & Accounting*, 28(1/2), 63-105.

Antoniou, A., Galariotis, E., Spyrou, S. I. (2005). Contrarian Profits and the Overreaction Hypothesis: The Case of the Athens Stock Exchange. *European Financial Management*, 11(1), 71-98.

Barak, O. (2006). Hisse Senedi Piyasalarında Anomaliler ve Bunları Açıklamak Üzere Geliştirilen Davranışsal Finans Modelleri –İMKB'de Bir Uygulama–. *Doktora Tezi*. Gazi Üniversitesi Sosyal Bilimler Enstitüsü. Ankara.

Bowman, R. G., & Iverson, D. (1998). Short-Run Overreaction in the New Zealand Stock Market. *Pacific-Basin Finance Journal*, 6(5), 475-491.

Bremer, M., & Sweeney, R. J. (1991). The Reversals of Large Stock Price Decreases. *Journal of Finance*, 46(2), 747-754.

Chen, M. W., & Zhu , J. (2005). Do Investors in Chinese Stock Market Overreact?. *Journal of Accounting & Finance Research*, 13(3), 17-25.

Clare, A., & Thomas, S. (1995). The Overreaction Hypothesis and the UK Stock Market. *Journal of Business Finance and Accounting*, 22(7), 961-973.

De Bondt, W. F. M., & Thaler, R. (1985). Does Stock Market Overreact?. *Journal of Finance*, 40(3), 793-805.

De Bondt, W. F. M., & Thaler, R. (1987). Further Evidence on Investor Overreaction and Stock Market Seasonality. *Journal of Finance*, 42(3), 557-581.

Dreman, D. N., & Lufkin, E. A. (2000). Investor Overreaction Evidence That Its Basis is Psychological. *The Journal of Psychology and Financial Markets*, 1(1), 61-75.

Durukan, M. B. (2004). Aşırı Tepki Hipotezi: İstanbul Menkul Kıymetler Borsasından Kanıtlar . *VIII. Ulusal Finans Sempozyumu Bildirisi*.

Ergün, B. (2009). Piyasa Anomalileri ve Aşırı Tepki Hipotezinin İMKB'de Araştırılması. *Yüksek Lisans Tezi*. Çukurova Üniversitesi Sosyal Bilimler Enstitüsü. Adana.

Fama, E. F. (1970). Efficient Capital Markets: A Review of Theory and Empirical Work. *Journal of Finance*, 25(2), 383-417.

Fung, A. K. W. (1999). Overreaction in the Hong Kong Stock Market. *Global Finance Journal*, 10(2), 223-230.

Lehmann, B. N. (1990). Fads, Martingales, and Market Efficiency. *Quarterly Journal of Economica*, 105(1), 1-28.

Liang, Y., & Mullineaux, D. . J. (1994). Overreaction and Reverse Anticipation: Two Related Puzzles?. *Journal of Financial Research*, 17(1), 31-43.

Nam, K., Pyun, C. S., Avard, S. L. (2001). Asymmetric Reverting Behavior of Short-Horizon Stock Returns: An Evidence of Stock Market Overreaction. *Journal of Banking and Finance*, 25(4), 807-824.

Öncü, S., Aktaş H., Kargın, S., Aktaş, R., Kayalı, N. (2006). Yatırımcıların Anormal Fiyat Değişimlerine Tepkisi: Gün İçi Verilerle İMKB Üzerine Bir İnceleme. X. Ulusal Finans Sempozyumu Bildirisi.

Seyhun, H. N. (1990). Overreaction nor Fundamentals: Some Lessons from Insiders' Response to the Market Crash of 1987. *Journal of Finance*, 45(5), 1365-1388.

Shiller, R. J. (1981). Do Stock Prices Move Too Much to be Justified by Subsequent Changes in Dividends.*American Economic Review*, 71(3), 421-436.

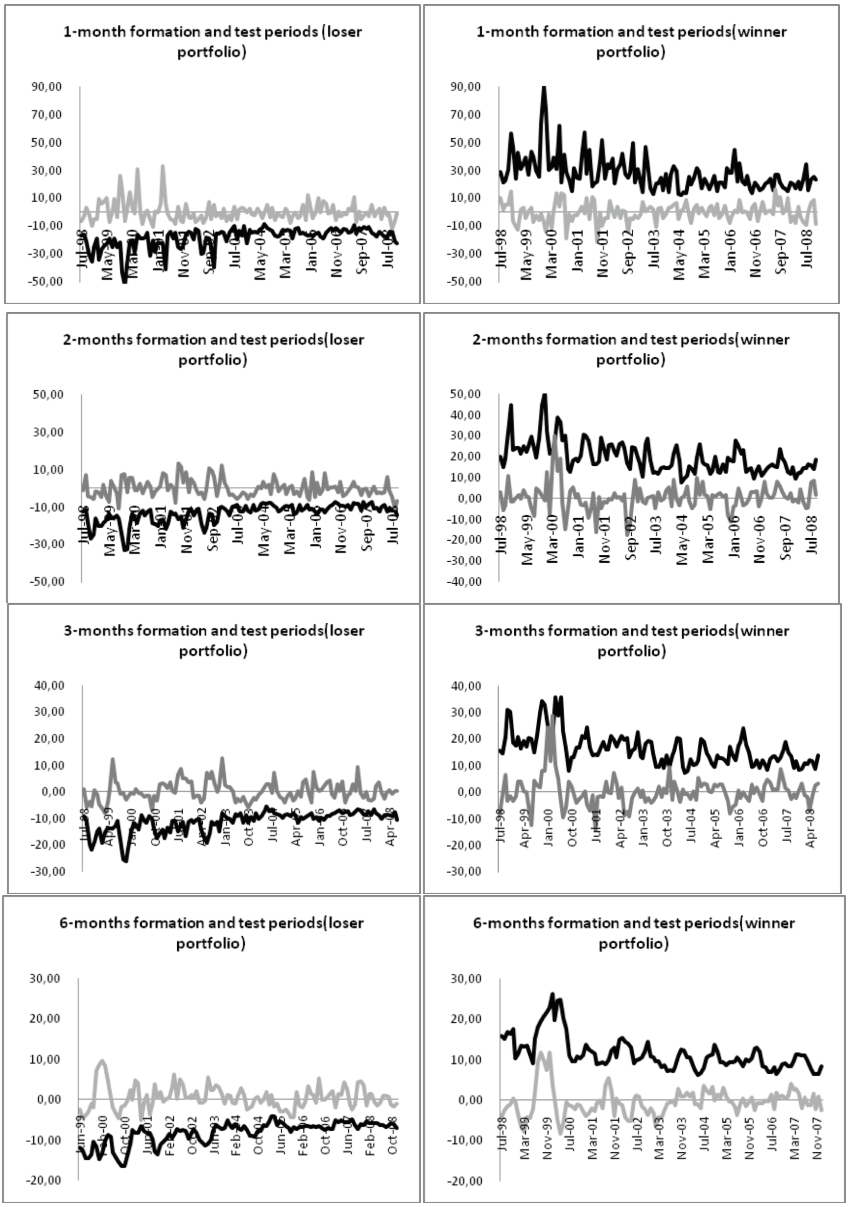
Taşkın, F. D. (2006). Overreaction Hypothesis: Evidence From Istanbul Stock Exchange. *Yüksek Lisans Tezi.* Dokuz Eylül Üniversitesi Sosyal Bilimler Enstitüsü. İzmir.

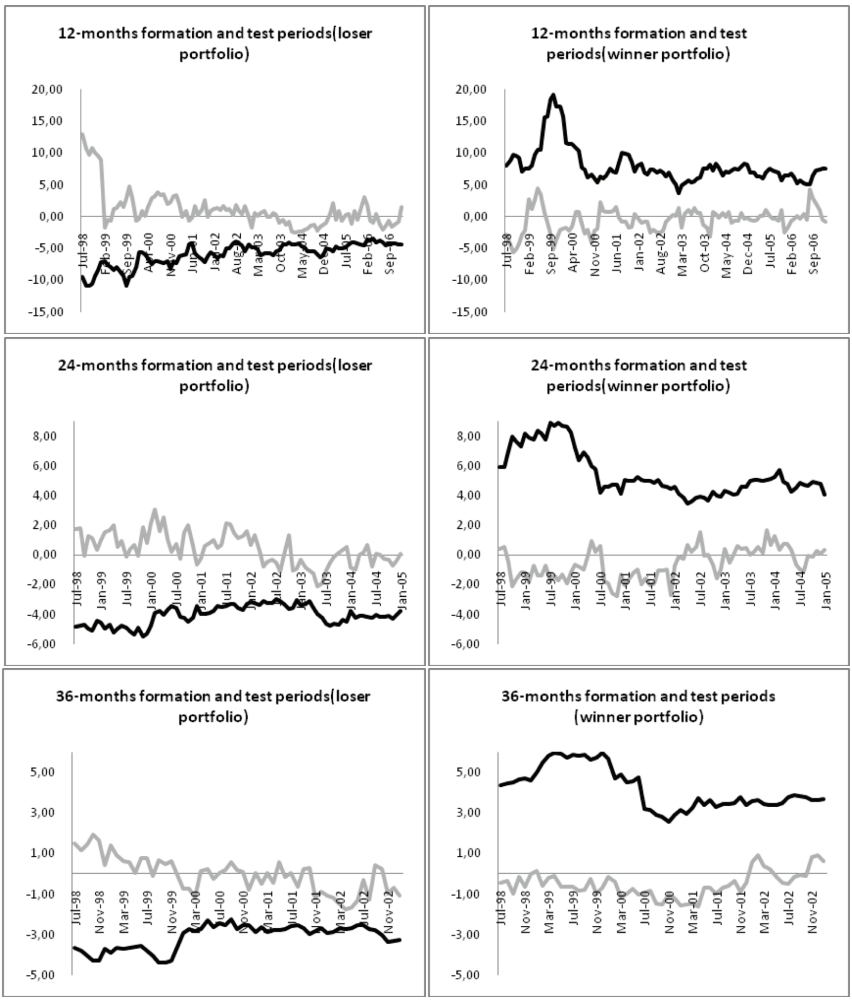
Thaler, R. H. (1987). Anomalies: The January Effect. *Economic Perspectives*, 1(1), 197-201.

Yücel, T., & Taşkın, F. D. (2007). Aşırı Tepki Hipotezi ve İstanbul Menkul Kıymetler Borsası'ndan Kanıtlar. *İktisat, İşletme ve Finans Dergisi*, 22(260), 26-37.

Appendix: ACAR Values of Loser and Winner Portfolios for Various Time Periods (%) (formation period test period**)**

The graphs show the return behaviors of the loser and winner portfolios for various portfolio formation and test periods.




12-months formation and test periods(loser portfolio)
12-months formation and test periods(winner portfolio)
24-months formation and test periods(loser portfolio)
24-months formation and test periods(winner portfolio)
36-months formation and test periods(loser portfolio)
36-months formation and test periods (winner portfolio)

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AN ANALYSIS OF MANIPULATION STRATEGIES IN STOCK MARKETS

Rasim Özcan*

Abstract
Manipulative transactions, which affect both the supply and demand side of the markets, have been studied by academic circles and it was concluded that manipulation exerts negative impact on markets. A market with manipulation is considered as less trustworthy and credible compared to a market without manipulation, which in turn, affects demand. Manipulations affecting both the supply and demand should be closely monitored by stock market investors as well as legislative, executive, and regulatory institutions. This paper aims to review economic and financial studies on manipulation in order to reveal what has done so far and what should and can be done. This paper, which compares different types of manipulation, also discusses main empirical studies on manipulation types.

Keywords: Manipulation, Stock Exchange, Empirical Study
JEL Classification: G1, G14, G15

I. Introduction

Communication and Information Technologies emerged in the last half century and have been big part of our daily lives starting from 1990s allow the financial transactions to be undertaken at very low costs. This has led the financial sector to reached unpredictable transaction levels. According to the World Federation of Exchanges, total trade volume of world stock exchanges was about US$ 81 trillion in 2009.[1] Comparing this value, which includes transactions only from stock exchanges and excludes transactions of other financial instruments such as options and government bonds, with US$ 70.3 billion of total world economic production in 2009[2] reveals how big financial markets size is.

* Rasim Özcan Ph. D, Türk Telekom, Akatlar Mah. Prof. Dr. Kaya Çilingiroğlu Cad. No: 10, 34337 Etiler-Beşiktaş/İstanbul, Turkey. Phone: +90 (212) 306 80 58, Fax: +90 (212) 352 96 10 E-mail: rasim.ozcan@turktelekom.com.tr

1 This value only includes members of World Federation of Exchanges. (World Federation of Exchanges, Home Page, Access Date: 18.08.2010. http://www.world-exchanges.org/files/statistics/excel/EQUITY509.xls) (WFE Home Page)

2 CIA World Factbook, 2010, Access Date: 18.08.2010, https://www.cia.gov/library/publications/the-world-factbook/geos/xx.html.

Naturally, in such a high volume market one may expect existence of market participants seeking profits via actions based on deceiving others. The term "manipulation" is used to express such transactions aimed to make profits that cannot be made under normal market conditions. Not only topics from the definition of manipulation to its effects on traders, market participations, and markets have raised the academic interest and been studied in economics and finance literature, but also been taken seriously by executive and regulatory institutions.

The aim of this study is to identify the current situation of literature by investigating studies on manipulation from economics and finance literature and finding out the directions that needs further work. Despite the importance of manipulation, studies especially empirical studies are far from adequate levels. The main reason is mostly the confidentiality of data needed to undertake an empirical study on manipulation; hence academicians are given limited access to such data. However, even with this limited access to data there are studies concluding the existence of variety of manipulations, discussing the effects of market regulations to avoid such manipulations and proposing new regulations/adjustments to have more reliable markets.

In this paper, I compare various definitions of manipulation and overview manipulation types. Then, I discuss selected empirical studies that examine various manipulation types. The structure of the paper is as follows. Section 2 answers the question of "why manipulation?" Section 3 discusses the definitions of manipulation as a term. Section 4 refers the classification of manipulations into action-based, information-based and trade-based. An analysis of empirical manipulation studies is given in Section 5. Section 6 concludes the paper.

II. Why Manipulation?

The importance of manipulation in terms of its size and effects can be better understood with the example of Citigroup's buy-sell orders in 2005. On August 2nd, 2005 Citigroup sold about 200 bonds amounting EUR 11 billion in a period of less than two minutes in Eurozone. Immediately after that, EUR 4 billion worth of the bonds were bought at a lower price. As a result of these transactions' adverse effects on liquidity in the Eurozone, the Financial Services Authority conducted investigation about the incidence and reached an agreement with Citigroup. According to the agreement, Citigroup accepted to pay total of

EUR 13.9 billion (about US$ 25.3 billion) of which EUR 4 billion as fine and the rest was the profit made from the transactions.[3]

Since the transactions with value of billion dollars/euros can be executed within a few minutes, the changes as a consequence of Citigroup's transactions in this example can be easily monitored. However, the existence of manipulations carried out within seconds or shorter time periods is possible and their collective influences on markets should be analyzed.

The manipulative actions influencing both supply and demand sides of markets have been subjects of academic studies. Some conclude that manipulations have negative effects on market operations. For example, Comerton-Forde and Putnins (2009), which analyzes short sells, states that even the knowledge of the existence of manipulation by market participants adversely influences price accuracy and liquidity. This prevents markets from playing their most significant roles; the accurate information diffusion and efficient allocation of resources. According to Comerton-Forde and Putnins (2009), these create hesitations for firms to go on public which as a result raises the cost of capital.

Manipulation can negatively affect demand as well as supply. Guiso et al. (2008), which studies the implications of the impact of market credibility on investors, finds out that investors take the probability of being cheated during stock transactions into account; investors with high trust on markets invest bigger portion of their funds on stock markets. They also mention in their study that in addition to buying more stocks, such investors evade high risky stocks less.

Credibility of manipulative markets will be less than without it and this affects demand. Manipulations, which influence both supply and demand, have potential to cause significant negative results as in Citigroup example. Hence, they have to be closely monitored by market participants, legislators, and regulatory institutions.

III. Defining Manipulation

Although manipulation has taken the attention of investors and regulatory institutions since beginning of 1900s, a universal definition still does not exist. Every party defines the term by evaluating from different perspectives and hence

[3] Munter, P., Jenkins, P., Madelin, T., and Crawford, L. (2004), "Citigroup traders face criminal probe in bond case," *Financial Times*, 24.01.2005. Munter, P. and Osman, Y. (2005), "Citigroup in £14m settlement over bond trading," *Financial Times*, 27.06.2005.

small differences exist between definitions made by different sources. Recently studies are conducted about the definition of manipulation, especially by legal authorities. The authorities try to determine which market transactions should be regarded as manipulation.[4] In this section, the definitions of manipulation from academicians and regulatory institutions are overviewed.

In one of the recent academic studies, Jarrow (1992) defines market manipulation trading strategy as "one that generates positive real wealth with no risk." Jarrow, getting far from this definition, which is similar to the definition of arbitrage in academic literature, defines manipulation occurrence in a study with Cherian (Cherian and Jarrow, 1995) as "market manipulation occurs when an individual (or a group of individuals) trades a firm's shares in a manner such that the share price is influenced to his advantage."

Legislators and regulatory institutions consider the aim of manipulation besides its effects on trading and price formation. US Securities and Exchange Commission, SEC, define manipulation as "intentional conduct designed to deceive investors by controlling or artificially affecting the market for a security."[5]

In its bulletin "Market Abuse," European Union defines manipulation in three different ways in 2003. These are "transactions or orders that have false and misleading effects on the demand for and supply of capital market instruments or aim to reach abnormal and artificial price levels of capital market instruments; trading of other transactions based on deceptive and contrivance facts; dissemination of information about capital market instruments which generates/is able to generate false and misleading influences."[6]

In Turkey, Capital Markets Board (CMB) states the following about the stock market manipulations:

"In the definition of manipulations by legal frameworks and judgments of various countries, generally outside interventions to market operations are stated. In these definitions, manipulation is expressed as deceiving behaviors that lead people to buy/sell a security or behaviors that aim to hold the security's

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[4] For examples: Nelemans, Matthijs, 2008, "Redefining Trade-Based Market Manipulation", *Valparaiso University Law Review*, TILEC Discussion Paper No. 2008-003. Available at SSRN: http://ssrn.com/abstract=1078423; Kyle, A.S. and Viswanathan, S. (2008), "How to define illegal price manipulation", *American Economic Review* 98, 274-279.

[5] SEC Home Page, Access Date: 19.08.2010, http://www.sec.gov/answers/tmanipul.htm.

[6] CMB (Capital Markets Board), (2003), "Hisse Senedi Piyasalarında Manipülasyon, Kullanılan Yöntem Örnekleri, Manipülatif İşlem Kalıbı Örnekleri, Korunma Yolları."

price at an artificial level. Definitions such as intentionally avoiding the independent interaction of supply and demand exist as well. According to these definitions, actions that aim (1) influencing price mechanisms by avoiding independent interaction of supply and demand (2) leading people to trade a security by deceiving them (3) holding securities' prices at artificial levels, are called as manipulative."[7]

IV. Classification of Manipulation

Although academic discussions about the definition of manipulation continue, academicians and market actors use similar classifications about the types of manipulations. Allen and Gale (1992), which is one of the main references for theoretical manipulation studies, mention three classes of manipulations. These classes and their definitions are

Action-Based Manipulation: According to Allen and Gale (1992), manipulators goal in this type of manipulation is to make profit by affecting a stock's price with real actions and leading the price to their desired levels. Allen and Gale (1992) give transactions of American Steel and Cable Company's managers' conducts in 1901 as an example of action-based manipulation. In those transactions, managers firstly take short positions, then by closing one of the steel plants they led firm's stock price to decrease to US$ 40 from US$ 60. Then they close their short positions at US$ 40. After that by reactivating the closed plant, they pushed the stock's price level up back to its normal level. As a result they made significant profits.

Information-Based Manipulation: Manipulators aim to lead prices by providing false information or by disseminating rumors.[8] This type of manipulations covers various actions such as providing misleading information via forums, sending spam e-mails and whispering incorrect information to news sources.

Trade-Based Manipulation: Traders try to manipulate stock price only via trading, without any dissemination of incorrect information or any observable and price leading actions.[9] A good example of trade-based manipulation is wash sales. Another example is *runs* ("yoğunlaşma" by CMB). In runs, a group of investors sell significant amount of stocks instantly and without any base,

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7 CMB (2003)

8 In Allen and Gale (1992) and CMB (2003), similar definitions are given.

9 Allen and Gale (1992)

leading price drops. After enough decrease in the price observed, other investors sell their stocks with panic. As a result manipulators who sold their stocks at high prices have the chance to buy back the stock at lower price levels. Since there is no real reason for decreases in the stock price, the prices would return to their previous levels giving the way for manipulators to make profits. This method can be conducted other way around too. i.e. first extensive buy leading to price increases and then sell at higher price levels; at the end price goes down to its original level.

V. Empirical Manipulation Studies

Although empirical studies about both information-based and trade-based manipulations exist in the literature, these studies are limited in terms of their numbers and content. Especially, studies about trade-based manipulations have to do analyses with limited data because of insufficient data or confidentiality of data. Hence, there is limited information about how manipulations carried out, their mechanisms, and how to detect them and their effects on markets.

In this section, the methods and results of empirical studies about manipulations are analyzed. I mention three types of manipulations in the previous section. According to Allen and Gale (1992), the legislations to prevent two of these three types, information-based and action-based manipulations, are mostly successful. For that reason, I do not discuss studies about action-based manipulations here. However, after Allen and Gale (1992), with spread of internet technology new types of information-based manipulations have emerged. Therefore, I firstly discuss a group of studies on the information-based manipulations which cover incorrect news on internet forums and spam e-mails. Secondly, I discuss studies on trade-based manipulations. In the final group I overview studies using data on judicial cases. The studies on this final group may cover both information-based and trade-based manipulations.

5.1. Information-Based Manipulations

In the information-based manipulations, manipulators aim to lead prices to their desired levels by disseminate misleading information or spreading baseless rumors.[10] Some examples of information-based manipulations are cooperation of manipulator traders and media members to prepare incorrect news, writing

[10] In Allen and Gale (1992) and CMB (2003), similar definitions are given.

misleading messages on internet forums and sending spam emails with misleading information.[11]

Considering that the internet has just 20 years of wide-spread usage, emergence of studies on information-based manipulations at the end of 1990s is not surprising. However, the scarcity of such studies since 1990s grabs many people's attention. One of the reasons of this scarcity may be the need of complex computational linguistic methods to use the information in forums, which is in the form of composition/discussion, in quantitative studies. In the remaining part of the section, some studies, which make linguistic computations on spam e-mails and forum messages, will be discussed.

5.1.1. Spam Emails

Today spam e-mails, which constitutes significant portion of e-mail traffic, become one of the methods used by manipulators. Just very recently appearing in the literature, spam e-mails are investigated by Frieder and Zittrain (2006). According to Frieder and Zittrain (2006), manipulators firstly invest on penny stocks, and then they send spam e-mails that advise investing on those penny stocks. When investors start to buy the penny stocks after receiving the e-mails, manipulators make profit by selling stock they hold at a high price that is reached due to increased demand. Although the spam emails most of the time has statements like the sender of the e-mail will make profit if the stock is bought by the email receiver, since such statements are in small fonts they can be easily overlooked and ineffective on the receiver (Frieder and Zittrain, 2006). This type of manipulations, though based on both information and trade, are treated in information-based manipulations.

Frieder and Zittrain (2006) analyze the spam emails advising to buy a stock, which are sent to a spam tracking group and the mail box of one of the writers from January 2004 to June 2005. They check the performance of the stock before, after and during the date of the spam e-mail. The study covers mostly penny stocks, i.e. stocks mostly illiquid and open to manipulations. The data set of the study consists of 75,415 spam e-mails at which total of 307 stocks are advised to be bought. They find out that in the day and previous day of intensive

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[11] In addition, misleading markets via incorrect disclosure of financial ratios can be counted as information-based manipulations. (Öğüt, H., Aktaş, R., Alp, A. and Doğanay, M. (2009), "Prediction of financial information manipulation by using support vector machine and probabilistic neural network". *Expert Systems with Applications*. 36 (3): 5419.) (Öğüt et al. (2009))

e-mail delivery the aforementioned stocks obtain higher returns than the market. However, following days' returns remain below the market returns. In addition, trade volume increases with spam e-mails as well. The study reveals that investors trading with the guidance of those spam e-mails suffer 5.25% loss on the average. Unfortunately, detection of spam sender's position except for stocks stated in the spam e-mails is not possible. However, writers state that their results are in line with the hypothesis that supports the existence of manipulation. According to the hypothesis, spam senders buy the stock first and then raise the price of stocks by sending spam e-mails. In the following days, as a result of manipulators selling stocks to benefit from higher prices, stock prices fall down to the original level.

This research is an interesting study not only for showing the effects of spam emails on stock exchanges, but also showing that spam emails considered as undesired and not be read, are taken seriously by a portion of the recipients that may create apparent impact on stock prices.

Another interesting result of this study is the success degree of legal notices. Almost in all the analyzed spam e-mails, although with small fonts, senders include a note stating that they are paid to send e-mails or/and they can sell the mentioned stock in the e-mail. Even though this is the situation, it is interesting that market participant, who receives such emails, make investments with 5% on the average potential losses. Writers advise to legislators and market regulators not only imposing obligatory legal notices, but also taking steps to make trading harder for those who send such emails.

5.1.2. Internet Forums

A widely used way of spreading delusive news is writing incorrect messages on forums such as Yahoo! Finance, Raging Bull, The Motley Fool and Silicon Investor. The main studies analyzing such messages are Wysocki (1998) and Antweiler and Frank (2004). These studies consider these messages not as manipulative behaviors but environment for information exchange between market participants. However, as in trade-based manipulations, the existence of market participants who aim to make profits via spreading incorrect news cannot be ignored. Hence, it is important to examine the effects of messages in forums on markets.

According to Antweiler and Frank (2004), the very first study that examines internet forums in scope of financial markets is Wysocki (1998). Antweiler and Frank (2004), who studies company characteristics that have impact on the

number of forum messages; show that the highly mentioned companies in internet forums have higher average market value, extreme profit history and accounting performance, high price-profit ratio, high volatility and traded value, and high analyst track. After all of these features, it can be stated that internet forums mention highly visible companies more.

Since there is correlation between company characteristics and number of messages, the point that should be studied is the effects of messages on markets. Antweiller and Frank (2004) try to enlighten this subject by examining messages in Yahoo! Finance and Raging Bull. Analyzing over 1.5 billion messages written in 2000 and about 45 stocks traded in Dow Jones Industrial Average (DIA) and Dow Jones Internet Commerce Index (XLK), they categorize these messages as "buy, hold, sell" by using Naive Bayes Classifier.[12] After that, writers find which of the three categories – bullishness, bearish and neither – "average message" advises by taking average of whole day's messages. Then, they study on correlation between stock prices and "average message" suggestions.

The main result of this study is that if the "average message" suggests bullishness in a day, a small decrease in the stock price occurs on the following day. However, this effect reverses on the next day. Although this drop is statistically significant, it is not at a degree of covering transaction costs and providing arbitrage chance. In addition, they study on correlation between stock volatility and messages; they find out that growth in the number of messages can be used as an indicator of predicting volatility. In summary, this study show that forum messages are not totally noise but have impacts on markets.

5.2. Trade-based Manipulations

According to Allen and Gale (1992), trade-based manipulation occurs when traders attempt to manipulate the price of a share via buying or selling, rather than leaking false information or taking any publicly observable action with the aim of changing the share price. Most significant examples of trade-based manipulation are runs, spoofing, corners, opening/closing price manipulation, and wash sales. In this section, different trade-based manipulation types and academic studies covering those types are discussed.

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[12] According to Antweiller and Frank (2004), Naive Bayes classifier is the oldest method of document categorization and is still the most successful algorithm. In scope of this paper, Naive Bayes method is used to detect the category of messages by analyzing words in messages and using the frequency of words. First of all, writers manually classify 1000 messages and enter them into computer as educative data. Then, system categorizes all of over 1.5 million messages in database by using frequency of words in the messages and finding the category of these messages with highest probability.

5.2.1. Runs

The Capital Market Boards of Turkey defines runs as a group of investors buy (sell) significant amount of stocks and without any base in an attempt to create the image of a lively market. The aim of intensive buys is to cause increases in the stock price by driving other investors to buy the stock and after some point to sell the stock at a higher price in order to gain benefits.[13] According to this definition, with runs, players aim to manipulate the stock markets by simply performing transactions on the demand side.

In the finance literature, similar manipulation types exist where transactions are performed on both the supply and demand side in order to affect other investors and encourage them to engage in buying-selling activities. These manipulation types could also be gathered under runs. According to Khwaja and Mian (2005), trade-based manipulation strategy called "hype and dump", which is chosen to be evaluated as runs, starts with colluding brokers to trade among themselves in order to artificially raise prices and attract naive traders. Later on, with the prices on the rise, these colluding brokers exit the market, causing the naive traders to suffer from the subsequent price falls.

Khwaja and Mian (2005), which stands out as the most comprehensive study on runs, is the first one to use a data set containing all daily trades of each broker in every stock trading on the Karachi Stock Exchange (KSE) during a two and a half year period (December 1998-August 2001).

The authors first determine trades done by a broker on his own behalf and trades done on behalf of investors, and then find out that when brokers trade on their own behalf they earn 50-90% higher annual returns. The study analyzes this excess returns further in-depth and find evidence for runs. They firstly show that on days when the stock prices are relatively low, most of the trade is done on the brokers' own behalf, whereas on days when the stock prices are high, most of the trade is done on behalf of investors. Secondly brokers trading on their own behalf have strong predictive power regarding returns on stocks. The study shows that brokers buying and selling stocks among themselves when they are acting on their own behalf lead to positive returns. Moreover, no reason is found to suspect that the aforementioned trades and positive returns are both caused by some external factor. If this was the case, brokers should have engaged in either buying or selling but not both. Thirdly, decreasing prices right after the brokers'

[13] CMB (2003)

exit from the market is another indication that the trading and price increases are artificial.

In addition, after showing robustness of their results under different assumptions, finally the impact of this manipulation type on the wealth allocation is also examined. Khwaja and Mian's (2005) conservative estimates reveal a transfer of US$ 100 million from investors to manipulating brokers in every year, which accounts 44% of the broker earnings. Moreover, the authors reveal that this transfer stands around 10% of the KSE, underscoring that in a country with a GDP per capita of US$ 450, this is a significant wealth transfer.[14]

5.2.2. Spoofing

Some traders could choose to affect the price of a share by placing orders with little chance of being executed in order to convince other investors that there is an imbalance between the demand and supply of a stock (Eom et al. 2009). This manipulation type is called spoofing with the spoofing trader later submitting his real order and taking advantage of the price change caused by the earlier spoofing order. The authors put spoofing not under trade based manipulation as it is based on fictive order not real executed orders but under "microstructure-based manipulation." However, in this study spoofing is put under trade based manipulation as it involves submitting orders whether they are executed or not.

Eom et al. (2009) uses the complete intraday individual accounts order and trade data from the Korea Exchange (KRX) spanning the period of November 2001-February 2002. While during the first two months of the data period, the KRX disclosed the total volume of buy and sell orders without releasing the price levels, during the last two months, the KRX ceased disclosing the total volumes. The authors showed that traders carrying out spoofing make extra profits in the range of 67-83 basis points within 45 minutes. Furthermore, prior to the change in the disclosure rule, spoofing orders constituted most of the total orders, whereas following the change in the disclosure rule, the share of spoofing orders decreased significantly, confirming that the microstructure of the KRX was paving the way for spoofing orders. The interesting point is that by disclosing the total quantity of buy and sell orders the KRX initially aimed to enhance the market transparency. Yet, the authors highlight the fact that the micro-structural modification gives the way to "microstructure-based manipulation" rather than enhancing transparency in KRX.

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[14] Öğüt et al. (2009) study trade-based manipulations with ISE data as well.

5.2.3. Corners

Wyckoff (1972) compiling the chronology of the Wall Street, defines corners as -a market condition brought about intentionally, though sometimes accidentally, when virtually all of the purchasable, or floating, supply of a company's stock is held by an individual, or a group who are thus able to dictate the price when settlement is called.-

Allen, Litov, and Mei (2006), who also studied corners, define successful corners as "those where the manipulator controlled almost all of the floating shares during the short squeeze and were able to dictate prices", while defining failed corners as "those where the manipulators attempted but failed to control the large amount of floating shares either because of large amounts of new shares that were brought to the market on the settlement date or because of government action".

One of the near-term examples of corners occurred in October 2008. Porsche disclosed that it owns 42.6% of the Volkswagen (VW) and have acquired options for another 31.5% with an ultimate goal of acquiring 75% of the company. Following the announcement, hedge funds opted for short-selling in order to gain advantage due to the expectation of fall in its price. However, the German state of Lower Saxony owning a 20% stake in VW said that it would not sell any shares. At the end, owing to the liquidity problems, the share price of VW jumped from about EUR 200 (about US$ 265) to above EUR 1,000, making VW the world's most valuable company for a short period of time.[15]

Allen et al. (2006) first developed a rational expectations model on corners and show that corners could arise from rational behavior of all market players. The authors then, based on the Wyckoff's (1972) chronology compilation, investigate 13 corner cases occurred between the years of 1863-1980. Most corners involved the robber-barons of the time like Cornelius Vanderbilt, and J. P. Morgan, who were in a position to exploit small investors as in many cases they were company employees or large shareholders. According to the authors, this is the common feature of these corner cases. Moreover, the authors show that the share prices display large jumps during the corner manipulation periods, resulting in major disruptions in orderly functioning markets.

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[15] Norris, F. (2008), "Porsche reinvents the short squeeze," *The New York Times*, 2008.10.30, Access Date: 25.09.2010, http://www.nytimes.com/2008/10/30/business/worldbusiness/30iht-norris31.1.17372644.html.

According to the authors, the presence of more informed large (deep-pocketed) investors paves the way for corners manipulation and makes short-selling risky for arbitrageurs, which eventually, hurts the markets by reducing the liquidity. The study also shows that corners could increase market volatility and also have an adverse price impact on other share prices.

The authors stated that it was easier to take large short positions in the past, which made corners more prevalent and more successful. Furthermore, margin calls being less restrictive in the past had also an important role. The authors note that in order to alleviate this manipulation type the New York Stock Exchange (NYSE) requires registering all securities traded, and 30 day notice on any new issues. Moreover, any person or group of persons acquiring more than 5% of a company should make the necessary announcement, which in turn brings transparency to large shareholders' positions.

5.2.4. Opening/Closing Price Manipulation[16]

Market players and media mostly monitor opening and closing prices, rather than intraday prices. In addition, opening and closing prices are used in many areas such as price formation, basis for closing accounts in derivative markets, valuation of mutual funds, and evaluation of traders' performances. As a result of the usage in estimating performance and valuations, various market players' attempts to manipulate opening and closing prices in different directions are expected, even observed in many stock markets around the Globe.[17]

This manipulation type that is driven by the imbalance in order books due to the last-minute orders or the artificial change in opening and closing prices via last-minute orders with low volume did come to the attention of many market regulators around the Globe and stock markets took various measures to alleviate this manipulation type.[18] Among these measures, implementing opening and

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[16] For detailed analysis of opening/closing price manipulations see Ozcan (2011)

[17] For example, In scope of opening/closing manipulations, Hillion and Suominen (2004) study on Paris Stock Exchange, Felixson and Pelli (1999) study on Helsinki Stock Exchange and Comerton-Forde et al. (2007) study on Singapore Stock Exchange. In Turkey, Küçükkocaoğlu (2008) studies on opening and closing manipulations in ISE. In addition, Bildik (2001) shows that in ISE due to two-sectioned structure transactions track W shaped distribution. Akyol and Michayluk (2009) discuss opening/closing manipulations using this W shape.

[18] Felixson, K. and Pelli, A. (1999) "Day end returns – stock price manipulation", Journal of Multinational Financial Management 9, 95-127; Hauser, S., A. Kamara and I. Shureki, "The Effects of Market Design on the Informational Efficiency and Manipulation of Prices", 2009, mimeo (Hauser et al. (2009)).

closing call auctions[19] and even conducting these auctions at random times stand out.[20]

5.2.5. Manipulative Use of Short-Selling

The literature on manipulative use of short-selling, which came back to agenda with the 2008 financial crisis and stirred up heated debates about whether it was one of the reasons of the crisis or not, increased in the last two years.

Blocher et al. (2010) study manipulative use of short-selling in the New York Stock Exchange (NYSE) and how year-end prices were affected. The authors find out that the reflection of short-selling on prices is temporary in nature and a correction in prices occurs right at the beginning of the new year. The study investigates whether this temporary price change could confirm manipulation or not. The authors conclude that the convex structure of hedge fund managers' salaries could lead to manipulative actions. The study also notes that short-selling manipulates prices in much the same way the manipulation via regular buying-selling does.

In another study on manipulative use of short-selling, Comerton-Forde and Putnins (2009) tests the hypothesis that short-sellers possess more information on the market compared to other players, and thereby, they contribute to the market efficiency. The authors, who state that there are some studies on manipulative use of short-selling in the literature such as Gerard and Nanda (1993) and Goldstein and Guembel (2008), use all short-selling transactions data on 350 selected stocks in the NYSE between the years 2006-2008. Unlike the other studies in the literature covering the yields of stock portfolios with different weights, this study by using the transaction-based yield data suggests that short-selling could notice permanent negative yields and contribute to the market efficiency during times of overpricing by exerting opposite pressure. The study also reveals that during those times of overpricing, players taking short-selling positions managed to make extra yield of 3.26% in 2006 and 2.4% in 2008. The study finds evidence that major negative price corrections were driven by non-short sellers rather than short-sellers themselves, suggesting that market regulators imposing restraints on short-selling could have a negative impact on the market efficiency. However, the study underlines that some part of short-

[19] According to Hauser et al. (2009), London Stock Exchange and NASDAQ use both opening and closing call auctions.

[20] According to Hauser et al. (2009), Tel Aviv, Toronto and Australia conduct random time opening call auctions.

sellers, players taking naked short-selling positions, could be related to manipulation, and therefore, market regulators imposing restraints on naked short-selling could contribute to the credibility of the market.

5.3. Criminal Cases

I have already stated that despite the importance of manipulation, empirical studies on the issue remained inadequate partly due to the necessary data to work on being considered as confidential in many markets and thus, academicians having limited access to those data sets. Yet, academicians try to overcome this challenge by using data from alternative sources, rather than the data compiled from stock markets. One such source is data for the lawsuits filed against alleged manipulation cases which are not confidential and are publicly available.

Comerton-Forde and Putnins (2008) state that manipulations in the US and Canadian markets mostly occur at the month and quarter ends, which may be considered as the evidence for fund managers-driven manipulations. By using the latent variable econometric model, which is based on the Heckman-Selection model, they estimate that for each prosecuted manipulation case, approximately 400-440 manipulation cases remain undetected or unprosecuted.

Using a criminal case database, Aggarwal and Wu (2006) builds a theoretical model examining the presence of a manipulator and a bunch of market players seeking information. They theoretically show that the raise in the number of market players seeking information meant higher profits for manipulators, therefore, lower market efficiency. The study notes that in such cases, interventions of market regulators could increase market efficiency. They also work with the data on manipulation cases pursued by the US Securities and Exchange Commission (SEC) between the years 1990-2001. In that study they find out that during a manipulation period, stock prices tend to rise, while decreasing during the post-manipulation period. Furthermore, during a manipulation period, manipulated stocks tend to face higher liquidity and volatility.

VI. Conclusion

Financial markets are growing faster than envisaged, while manipulation in these markets continues to be closely monitored by lawmakers, executive and regulatory institutions and other market players. In many cases, market players engaging in manipulation try so hard to cover up their trace as manipulation is

illegal. In addition, empirical studies on the issue remained inadequate in terms of both quantity and quality partly due to the necessary data to work with being considered as confidential and thus, academicians having limited access to such data.

In this paper, academic studies on different manipulation types and their effects, which were conducted with limited data access, are discussed. These studies conclude that both information and trade-based manipulations exist in many stock markets around the Globe; more importantly, manipulations affect both the supply and demand channels negatively. Yet, despite the empirical anomalies observed in the markets, some studies reveal that the data sets don't conflict with the hypothesis tested, rather than showing in an unquestionable way that these anomalies are caused by manipulation.

The manipulation literature could move forward in two directions. First of all, with the progress made in the IT sector, manipulators could use more creative manipulation types. These trends should be followed and new manipulation types should be studied. Secondly, studies done by using data from developed country should be customized and re-conducted for developing economies since the results of studies on developed economies may not directly apply to developing economies.

References

Aggarwal, R., Wu, G. (2006), "Stock market manipulation", The Journal of Business 79, 1915–1953.

Akyol, A.C., and D. Michayluk, (2009), "Is there closing price manipulation on the Istanbul Stock Exchange?" Unpublished manuscript.

Allen, F., Gale, D. (1992), "Stock-price manipulation", Review of Financial Studies 5, 503-529

Allen, F., Litov, L. ve Mei, J. (2006), "Large investors, price manipulation, and limits to arbitrage: An anatomy of market corners", Review of Finance 10, 645-693.

Antweiler, W., ve Frank, M.Z. (2004), "Is all that talk just noise? The information content of internet stock message boards", Journal of Finance 59, 1259 - 1294.

Bildik, R. (2001), "Intra-day seasonalities on stock returns: evidence from the Turkish Stock Market." Emerging Markets Review 2, no. 4: 387-417.

Blocher, J., Engelberg, J. ve Reed, A.V. (2010), "The Long Short Wars: Evidence of End of Year Price Manipulation by Short Sellers". Available at SSRN: http://ssrn.com/abstract=1364835

Cherian, J.A., Jarrow, R.A., (1995), "Market manipulation," in Jarrow, R.A., Maksimovic, V., Ziemba, W.T. (Eds.), Handbooks in Operations Research and Management Science, Vol. 9: Finance. North-Holland, Amsterdam, pp. 611–630.

CIA World Factbook, (2010), Date of access: 18.08.2010, https://www.cia.gov/library/publications/the-world-factbook/geos/xx.html

Comerton-Forde, C., Lau, S.T., and McInish, T. (2007), "Opening and closing behavior following the introduction of call auctions in Singapore", Pacific Basin Finance Journal 15, 18-35

Comerton-Forde, C., Putniņš, T. (2008), "The prevalence and underpinnings of closing price manipulation", Unpublished working paper, Available at SSRN: http://ssrn.com/abstract=1083530.

Comerton-Forde, C. ve Putnins, T., J. (2009), "Pricing Accuracy, Liquidity and Trader Behavior with Closing Price Manipulation", 22nd Australasian Finance and Banking Conference 2009. Available at SSRN: http://ssrn.com/abstract=1296857

Eom, K.S., Lee, E.J. ve Park, K.S. (2009), Microstructure-Based Manipulation: Strategic Behavior and Performance of Spoofing Traders". Available at SSRN: http://ssrn.com/abstract=1328899

Felixson, K. and Pelli, A. (1999), "Day end returns – stock price manipulation", Journal of Multinational Financial Management 9, 95-127.

Frieder, L. ve Jonathan Z. (2006), "Spam Works: Evidence from Stock Touts and Corresponding Market Activity", Berkman Center Research, Publication No. 2006-11, 2006

Gerard, B., and Nanda, V. (1993), "Trading and manipulation around seasoned equity offerings", Journal of Finance 48, 213-245.

Goldstein, I., and Guembel, A. (2008), "Manipulation and the allocation role of prices", Review of Economic Studies 75, 133-164.

Guiso, L., Sapienza, P. ve Zingales, L. (2008), "Trusting the Stock Market", Journal of Finance. 63(6): 2557-2600.

Hauser, S., Kamara, A. ve Shureki, I. (2009)i "The Effects of Market Design on the Informational Efficiency and Manipulation of Prices", mimeo.

Hillion, P. ve Suominen, M. (2004), "The manipulation of closing prices", Journal of Financial Markets 7, 351-375.

Jarrow, R.A., "Market Manipulation, Bubbles, Corners, and Short Squeezes", The Journal of Financial and Quantitative Analysis, Vol. 27, No. 3 (Sep., 1992), pp. 311-336.

Khwaja, A. ve Mian, A. (2005), "Unchecked Intermediaries: Price Manipulation in an Emerging Stock Market", Journal of Financial Economics. 78:1 (Nov.): 203-41.

Küçükkocaoğlu, G. (2008), "Intra-Day Stock Returns and Close-End Price Manipulation in the Istanbul Stock Exchange – Frontiers in Finance and Economics" – Vol. 5 No.1 – April 2008.

Kyle, A.S., ve Viswanathan, S. (2008), "How to define illegal price manipulation", American Economic Review 98, 274-279.

Munter, P., Jenkins, P., Madelin T. ve Crawford, L. (2004), "Citigroup traders face criminal probe in bond case," Financial Times, 24.01.2005, Date of access: 25.09.2010., http://www.ft.com/cms/s/0/e3169bbe-6e44-11d9-a60a-00000e2511c8.html.

Munter, P. ve Osman, Y. (2005), "Citigroup in £14m settlement over bond trading", Financial Times, 27.06.2005, Date of access: 25.09.2010., http://www.ft.com/cms/s/0/4425730e-e73e-11d9-a721-00000e2511c8.html

Nelemans, M. (2008), "Redefining Trade-Based Market Manipulation", Valparaiso University Law Review, January 2008; TILEC Discussion Paper No. 2008-003. Available at SSRN: http://ssrn.com/abstract=1078423

Norris, F. (2008), "Porsche reinvents the short squeeze," The New York Times, 2008.10.30, Date of access: 25.09.2010., http://www.nytimes.com/2008/10/30/business/worldbusiness/30iht-norris31.1.17372644.html.

Öğüt, H., Aktaş, R., Alp, A. ve Doğanay, M. (2009), "Prediction of financial information manipulation by using support vector machine and probabilistic neural network". Expert Systems with Applications. 36 (3): 5419.

Ozcan, R. (2010), "Borsalarda Açılış Ve Kapanış Fiyatı Manipülasyonunu Önlemeye Yönelik Stratejik Tedbirler," Available at SSRN: http://ssrn.com/abstract=1736692

SEC Home page, Date of access: 19.08.2010, http://www.sec.gov/answers/tmanipul.htm.

SPK (Sermaye Piyasası Kurulu), (2003), "Hisse Senedi Piyasalarında Manipülasyon, Kullanılan Yöntem Örnekleri, Manipülatif İşlem Kalibi Örnekleri, Korunma Yolları."

Wyckoff, P. (1972), "Wall Street and the Stock Market: A Chronology (1644–1971)", Chilton Book Company, Philadelphia.

Wysocki, P.D. (1998), "Cheap Talk on the Web: The Determinants of Postings on Stock Message Boards" University of Michigan Business School Working Paper No. 98025. Available at SSRN: http://ssrn.com/abstract=160170.

World Federation of Exchanges Home page, Date of access: 18.08.2010. http://www.world-exchanges.org/files/statistics/excel/EQUITY509.xls

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EFFICIENCY AND LIMITED ARBITRAGE IN THE STOCK MARKETS: EVIDENCES FROM ISE

Bekir Elmas*

Abstract

In this study, we examine whether the arbitrage is limited for the trading stocks at Istanbul Stock Exchange (ISE), which is the stock market in Turkey. For doing so, stocks held by the companies traded at different groups such as A, B and C on ISE have been considered. By virtue of the study conducted, it has been determined that there is a long-termed correlation by and between the stocks held by the 3 different companies and traded under different groups and that deviations emerging in the short term have been corrected in a short time. Accordingly, it can be concluded that the arbitrage is not limited but operating on a rational basis for the stocks held by the companies trading at different groups such as A, B and C on ISE.

Keywords: Market efficiency, arbitrage, stock market
JEL Classification: D53, G11, G12

I. Introduction

In the Efficient Market Hypothesis (EMH), which strikes one's mind on hearing the words efficiency in the markets, the efficiency concept refers to the informational efficiency of the market. Informational efficiency means that all of the existing information is reflected to the securities prices thoroughly (Fama, 1970). In an informationally efficient market, a large number of rational individuals are competing with one another, significant information reaches to all participants easily, every participation is likely to react the inbound information differently and a mutually agreed price is formed in no time. In this way, prices of the securities will always reflect the fundamental values. In case of a deviation from the fundamental value due to irrational behaviors of an investor, the

* Bekir Elmas, Assist. Professor, Atatürk University, Faculty of Economics and Administrative Sciences, Department of Business Administration, Accounting and Financing.

rational arbitragers will then make sure that the assets reach up to the fundamental value once again.

People are assumed to be displaying extremely rational behaviors in the aforecited situation that describes the basic logic of the modern financial economy. However it is not the case in real life and people tend to deviate from rationality in a systematic manner (Barber and Odean, 2009). Another dimension of deviation from rationality is that there is a limited arbitrage in the market. If the arbitrage is limited in the market, the prices of the securities will, contrary to EMH, not be able to give the fundamental values.

In literature, it is specified that the arbitrage offers a risk-free gaining opportunity at no cost (Dybvig and Ross, 1992; Barberis and Thaler 2005). The arbitrage is limited by 3 factors in the markets. These factors are the Fundamental Risk, Noise Trader Risk and Implementation Costs (Barberis and Thaler 2005; Wei and Zhang, 2006).

Fundamental Risk forms a very obvious risk the arbitrager is likely to encounter. The risk is the possibility of even more decline in the price of the securities that have relatively lower value than the fundamental value. In an example employed by Froot and Dabora (1999) in their study, this situation is rather more obvious in case of the stocks owned by Royal Dutch and Shell, the associated companies, in the mid 1983. An arbitrager, who purchased Royal Dutch stocks, which were relatively cheaper, (10% cheaper) and who sold an equal number of Shell stocks, which were relatively expensive in the mid 1983, went through a substantial deterioration in his position due to a 25% decrease in prices in six months of time (Shleifer, 2000).

Noise Trader Risk; noise trader concept, introduced by Black (1986) was developed by De Long, Shleifer, Summers and Waldmann (DSSW-1990), hence it become a well accepted model. The fundamental notion of what DSSW (1990) model suggest is that unpredictability of the opinions by the irrational traders pose a risk for the securities in which they invest. Accordingly, the traders tend to trade depending on the noise and rumors rather than information in the capital markets. In a study conducted by De Long and others, *noise* trader risks is defined as “a stock price that the arbitrager thinks mispriced and hence has a position for arbitrage purposes only becomes even worse for the arbitrager due to the transactions by the noise traders” (De Long at al, 1990).

Implementation Costs; commission, price differences between buying and shorting, price impact etc. all of which are very well known to the circles make

it less attractive in order to take advantage of mispricing (Barberis and Thaler 2005). Simultaneously, it will be suitable to give place in this category to the cost of learning about and allowing for mispricing, as well as the cost of resources necessitated to take advantage of it (Merton 1987).

In this study, it is researched whether arbitrage is limited or unlimited for the shares of a company traded in different groups differentiating from available studies in the literature. It is thought that this study would contribute the literature in this respect.

II. Literature Research

Haris and Gurel (1986) and Shleifer (1986), one of the early studies thereanent, show that value of a stock increases by 3,5% when included in S&P 500 index, which is no temporary increase at all but is rather a permanent one. Yahoo stock is a good example for this. The price of Yahoo stock increased by 24% the day it was included in the index. As a matter of fact, the increase in Yahoo stocks continued and reached yup to the level of 83%.

The companies that unite under a certain agreement and trade at different stock exchanges are the research subject of Rosenthal and Young (1990), Froot and Dabora (1999). The profit received by the cited companies is shared pursuant to the agreement. The companies carry on with their commercial activities under the existing business name; likewise the stocks owned by these companies continue to be traded at the stock exchange under the existing name. The research result has put it very clearly and evidently that the arbitrage has been limited for these companies that are described as "Siamese twin" companies. In the studies, Royal Dutch and Shell Transport are one of the partners that had a merger by 60 to 40 in 1907. If the arbitrage had been limitless for the "Siamese twin" companies, the price of the stocks owned by Royal Dutch would equal to 1,5 of that of Shell Transport. This is, however, not the case and it has been found that there the prices had significant deviations from the given value.

Frankel and Lee (1998) have adopted a fundamental value-to-price (*Vf/P*) ratio-oriented approach in their study. The fundamental value determination relies on the error income model wherein analytical income estimations are used in the study. The fundamental value-to-price ratio estimates cross sectional stock returns for up to 3 years. A *Vf/P influenced Vf* represents traders' evaluation of a stock, so *Vf/P* ratio is characterized as an indicator to determine whether a stock

is cheap or expensive. It is also indicated in the study that it is likely to develop arbitrage strategies for buying very low value stocks and shorting very high value stocks by using such ratio.

Lamount and Thaler (2003) mention that 3Com, a company that sells computer networking systems and services, bought Palm Company, after which the latter offered 5% of its stocks to public in the stock exchange, treating of the stock prices of the two in the mean time. 3Com Company offered to public 5% of the stocks owned by Palm Company that it bought on March 2, 2000 and announced that it would give 1.5 Palm stocks in return for 1 3Com stock out of the remaining 95% of the stocks till the end of the year. In this case one 3Com stock should cost 1.5 fold of Palm stock in the market. It has been comprehended that the day when Palm Company offered 5% of its stocks to public was not exactly what has been expected, and 3Com stocks cost $104.13 only one day ago but it then regressed to $81.81 on the day of public offering. On the other hand, Palm stocks' price was closed at $95.06 then. Thus, 3Com stock price was actually expected to be $145 but was $63 below the value.

III. Data Set and Method

This study serves to test whether the arbitrage is limited to the stocks traded at the Istanbul Stock Exchange Market. To test whether the arbitrage is limited or not, first the existence of stocks owned by the companies whose stocks are traded at the ISE and that have a merger in this regard and that are engaged in buying and shorting under the same name has been scrutinized. Total earnings collected from the company amalgamation under a merger accord are distributed and yet it alludes to the companies whose stocks are traded under the same name as prior to the amalgamation in the market. As a result of the research, no stocks under such conditions have been found. As a conclusion, it has been resolved to check to see whether the arbitrage is limited for the stocks owned by the companies whose stocks are traded at different groups such as A, B and C. Following the research, it has been determined that stocks owned by 3 companies are being traded in groups. In this study wherein monthly data have been utilized, the data set has been provided by ISE. The companies referred to in the study, stock codes and the period of application have been indicated below.

Table 1: Companies Referred to in the Study, Stock Codes and Period of Application

Company	Stock Code	Period of Application
Adana Çimento Sanayii T.A.Ş.	ADANAA ADANAB ADANAC	10.1995 / 06.2010
CarrefourSA A.Ş.	CARFA CARFB	06.2008 / 06.2010
Karabük Demir Çelik Fabrikaları A.Ş.	KRDMA KRDMB KRDMD	09.1998 / 06.2010

As the first thing to do, the natural logarithm of the series has been taken. In time series analysis, the data should be stationary. Otherwise, in a model projected by employing non-stationary data, one often encounters with spurious regression issue. In this case, whether the regression represents a real relationship is closely correlated with stationary time series (MacKinnon, 1991; Gujarati, 1995). Dickey-Fuller designed and developed a test that integrates delayed values of a dependent variable into the model as an independent variable what we have employed in the test is the Augmented Dickey-Fuller (ADF) (Enders, 1995). In their study, Philips-Perron (1998) generalized the unit root test enunciated by Dickey-Fuller and developed, with a non-parametric approach, a brand new unit root test (Phillips and Perron, 1988). But in this approach, whenever the autocorrelations of the error term become highly negative, the Philips-Perron test encounter with the sample error of the error term. Once it was corrected, the Philips-Perron test is stronger than the ADF test (Schwert, 1989).

In this study, ADF (Augmented Dickey-Fuller) and PP (Phillips-Perron) unit root tests were implemented to the series in order to pick the correct model first, whereas in the test method of stationarity, the most trending/constant models have been used. The estimated equation for the ADF test (1) is given below.

$$\Delta y_t = \beta + \delta y_{t-1} + \sum_{i=1}^{p} \varphi_i \Delta y_{t-i} + \gamma trend + v_t \qquad (1)$$

The difference of PP unit root test from that of ADF unit root test is that delayed values of a dependent variable exist in none of the alternative equations.

In stead, after the equation number (2) is estimated, t statistics of the coefficient δ is corrected by Newey-West (1987) estimator.

$$\Delta y_t = \beta + \delta y_{t-1} + \gamma trend + \varepsilon_t \qquad (2)$$

In equations number (1) and (2), Δ means the difference operator, β means the constant term, ε_t and v_t mean the error term with white noise.

Provided two non-stationary time series are integrated on the same level, it is likely that they have a cointegration relationship. Cointegration relationship with non-stationary series is significant with no content of spurious regression whatsoever (Tarı, 2009). Engle-Granger is the one who brings in cointegration relationship between the series to the literature. The Engle-Granger (1987) test refers to the cointegration relationship on the one hand and there are certain drawbacks with it on the other hand. In order to make up the deficiencies, Johansen (1988, 1995) and Johansen-Juselius (1990) developed new cointegration tests. The cointegration tests developed by Johansen (1988, 1995) and Johansen-Juselius (1990) are implemented in this study.

While implementing the Johansen cointegration test, the most appropriate delay length is determined according to Schwarz Information Criteria in the first step. Two test statistics are suggested for being used in the Johansen cointegration tests. The first of them is Trace Statistic and the other is Maximum Eigen Value statistics. In the Trace statistic, the tested hypothesis is the co-integrated vector maximum in r number. The test statistic to test the hypothesis is indicated in the equation number (3) (Maddala and Kim, 1998).

$$\lambda_{trace} = -T \sum_{i=r+1}^{n} \ln(1 - \hat{\lambda}_i) \qquad (3)$$

Whereas in maximum eigen value test, the hypothesis “There are co-integrated vectors in r number” is established versus the alternative hypotesis “There are co-integrated vectors in r+1 number”. The test statistic employed in the maximum eigen value test is given in equation number (4) (Maddala and Kim, 1998).

$$\lambda_{\max} = -T \ln(1 - \hat{\lambda}_{r+1}) \qquad (4)$$

Cointegration correlation is found by comparing the outcomes of the trade and maximum eigen value statistics calculated according to the Johansen cointegration test to the critical values obtained by Johansen and Juselius (1990). If the trace and maximum eigen value statistics are greater than the critical values, it means there is a long-termed relationship by and between the series.

The cointegration correlation points to the long-termed relationship by and between the variables. To determine the short-termed relationship by and between the variables, an Error Correction Model (ECM) is established. This model shows how much of the deviations identified in integrated series during the long-termed relationship can be corrected in the short-term. Error Correction Model is referred to in the equation number (5) and number (6).

$$\Delta X_t = \alpha_{12} + \sum_{i=1}^{T_{11}} \beta_{11i} \Delta X_{t-i} + \sum_{j=1}^{T_{12}} \beta_{12j} \Delta Y_{t-j} + \mu EC_{t-1} + \varepsilon_{12t} \qquad (5)$$

$$\Delta Y_t = \alpha_{22} + \sum_{i=1}^{T_{21}} \beta_{21i} \Delta Y_{t-j} + \sum_{j=1}^{T_{22}} \beta_{22j} \Delta X_{t-i} + \lambda EC_{t-1} + \varepsilon_{12t} \qquad (6)$$

Where, X and Y Stock returns, T selected lag length, α and β show the parameters to be estimated, Δ the first-degree difference operator and ε_t shows white noisy error terms. Coefficients (μ and λ) pertaining to delayed error terms in EC_{t-1} show the speed of short-term equilibration.

IV. Company Data and Test Results

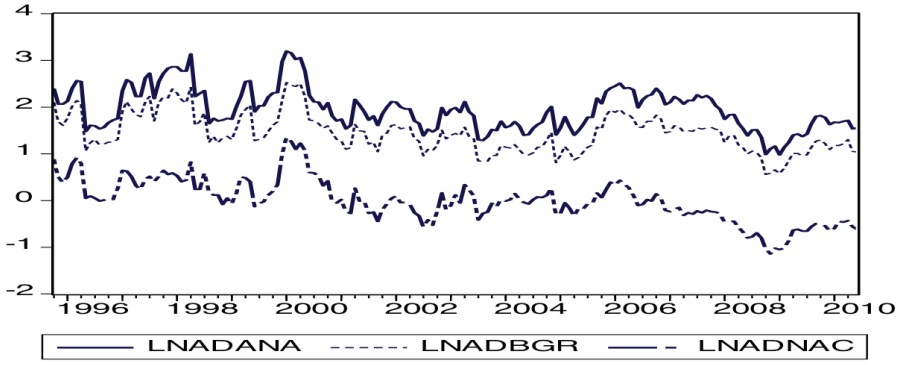
4.1. General Information on Adana Çimento Sanayii T.A.Ş. and Test Results

It was officially incorporated as Çukurova Çimento Sanayii T.A.Ş. by being published on the local newspaper on October 7, 1954 and started production in 1957. Business name of the company was changed to Adana Çimento Sanayii T.A.Ş. in 1986. It was resolved in 1986 to offer 47,29% of the company capital to the public, hence the stocks that were offered to public on February 12, 1991 were being traded at the ISE on February 21, 1991 under the following codes;

ADANA for Group A,
ADBGR for Group B,
ADNAC for Group C.

October 1995 when the ADBGR stocks began to be traded was selected as the inception of the implementation period. Fig. 1 shows that stocks of all 3 groups act together in the long-term during the implementation period.

Figure 1: Monthly Logarithmic Price Change for ADANA, ADBGR and ADNAC Stocks between October 1995 and June 2010.



Volatility in colloquial language means a state of fluctuation in due course, whereas in the economic literature, volatility acquires rather an official expression, referring to the state of change and standard deviation from the randomness of time series (Öztürk, 2010: 61). Financial time series usually involves more volatility, which is likely to change even more in time compared to macroeconomic time series. In such series, sharp decreases are followed by sharp increases and vice versa. On taking a look at the descrip!ive statistics of ADANA, ADBGR and ADNAC stock series in Table 2, we see that ADANA is the stock with the most volatility and ADBGR is the one with the least volatility. According to Jarque-Bera test statistic, the series show normal distribution on a significance level of 1%.

Table 2: Definitive Statistics of the Series

SERIES	Max.	Min.	Std. Deviation	Skewness	Kurtosis	Jarque-Bera (Prob)
LNADANA	3.20	0.98	0.45	0.50	2.95	7.47 (0.02)*
LNADBGR	2.53	0.56	0.42	0.47	2.85	6.59 (0.04)*
LNADNAC	1.35	-1.14	0.47	0.22	3.30	2.13 (0.34)*

Note: H_0 = Series distributed normally. *According to the 1% significance level, H_0 hypothesis cannot be rejected.

Table 3: Unit Root Test Results

STOCK	ADF UNIT ROOT TEST		PP UNIT ROOT TEST	
	LEVEL	1.LAG	LEVEL	1.LAG
LNADANA	-3.82 (0) [.018][b]	-	-3.93 (3) [.013][b]	-
LNADBGR	-4.16 (0) [.00][a]	-	-4.20 (1) [.00][a]	-
LNADNAC	-4.21 (3) [.00][a]	-	-4.21 (0) [.00][a]	-

CRITICAL TEST VALUES	
[a]1% significance level	-3.965363
[b]5% significance level	-3.413390
[c]10% significance level	-3.128731

Note: The numbers in parentheses show the delay distances chosen for ADF unit root test according to Schwarz Information Criteria and bandwidths determined according to Newey-West which uses Bartlett kernel for PP unit root test. The values in the square brackets show the p-values of ADF and PP statistics.

Table 3 shows the results of ADF and PP unit root rest results. It is observed from Table 3 that LNADBGR and LNADNAC series within 2 unit root tests is constant on a significance level of 1% while LNADANA series is constant on a significance level of 5%.

Table 4: Johansen Cointegration Test Results

VARIABLE PAIR	Trace Testing	Probabilities	Max. Eigen Value Test	Probabilities
LNADANA	15.09	0.017*	14.87	0.011*
LNADBGR	0.22	0.70	0.22	0.70
LNADANA	24.44	0.07**	16.78	0.11
LNADNAC	7.66	0.28	7.66	0.28
LNADBGR	24.05	0.08**	17.79	0.08**
LNADNAC	6.26	0.43	6.26	0.43

Note: While H_0: $r = 0$, $r \geq 1$ hypothesis was tested with 1. row values, H_0: $r = 1$, $r \geq 2$ hypothesis was tested with 2. row values. According to the *5% and **10% significance level, H_0 hypothesis is rejected.

The existence of a cointegration correlation is searched through the Johansen cointegration test. Results of the cointegration test are given in Table 4. Accordingly, the hypothesis H_0 suggesting that no cointegration exists between LNADANA and LNADBGR series on a significance level of 5%, and between LNADNAC, LNADBGR and LNADNAC series on a significance level of 10%

is rejected. These results show that there is a cointegration vector for each variable pairs.

Table 5: Long-Term Relationships from Error Correction Model

EQUATION 1: LNADANA = 0.35 + 1.11 LNADBGR	DENKLEM 3: LNADANA = 1.95 - 0.33 LNADNAC
EQUATION 2:LNADBGR = -0.30 + 0.89 LNADANA	DENKLEM 4: LNADNAC = 5.78 + 2.95 LNADANA
EQUATION 5: LNADBGR = 1.44 + 0.32 LNADNAC	
EQUATION 6: LNADNAC = 2.16 - 0.79 LNADBGR	

Table 6: Short-Term Relationships from Error Correction Model

EQUATION 1: Δ LNADANA = - 0.003 + 0.105 Δ $LNADANA_{t-1}$ - 0.168 Δ $LNADBGR_{t-1}$ - 0.430 EC_{t-1}	(-0.97)
EQUATION 2: Δ LNADBGR = - 0.004 + 0.314 Δ $LNADANA_{t-1}$ - 0.377 Δ $LNADBGR_{t-1}$ - 0.220 EC_{t-1}	(-2.05)
EQUATION 3: Δ LNADANA = - 0.003 + 0.045 Δ $LNADANA_{t-1}$ – 0.028 Δ $LNADNAC_{t-1}$ - 0.170EC_{t-1}	(-3.28)
EQUATION 4: Δ LNADNAC = - 0.007 + 0.206 Δ $LNADANA_{t-1}$ - 0.199 Δ $LNADNAC_{t-1}$ - 0.114 EC_{t-1}	(-2.54)
EQUATION 5: Δ LNADBGR = - 0.003 – 0.069 Δ $LNADBGR_{t-1}$ + 0.090 Δ $LNADNAC_{t-1}$ - 0.189 EC_{t-1}	(-3.45)
EQUATION 6: Δ LNADNAC = - 0.007 + 0.200 Δ $LNADBGR_{t-1}$ - 0.180 Δ $LNADNAC_{t-1}$ - 0.157 EC_{t-1}	(-3.15)

Note: The values on the right of the table are t-statistics of EC_{t-1} ,which the error correction term.

Table 5 and Table 6 show short and long-termed correlations obtained through the Error Correction Model. Table 5 gives the long-termed correlation obtained through the Johansen cointegration test. Table 6 shows to what extent the short-termed variations as observed in the series acting in concert in the long-term are corrected. EC_{t-1} coefficient, an error correction term in the short-term relationship is interpreted. Notation of the error correction term coefficient is found as "–" in all equations. The fact that coefficient notation of the error correction term is "–" means that short-termed deviations between the series that act in concern in the long term are eliminated and the series converges towards the long-termed balance relationship. Consequently, in the analysis herein, deviations in the short-term within the series of LNADANA-LNADBGR, LNADANA-LNADNAC and LNADBGR-LNADNAC wherein error correction mechanism operates and that act in concert in the long-term, are eliminated and the series converges towards one another.

4.2. General Information on CarrefourSA A.Ş. and Test Results

Having opened its very first store in France on June 15, 1963, Carrefour today is a retail chain with more than 12 thousand stores in 29 countries. After opening the first store of Turkey in Icerenkoy in 1993, Carrefour cooperated with Sabancı

Group in 1996 and was named CarrefourSA. Company stocks are traded under CARFA and CARFB codes at the ISE.

Figure 2 shows that CARFA and CARFB stocks act in concert in the long term.

Figure 2: Monthly Logarithmic Price Change for CARFA and CARFB Stocks between August 2006 and June 2010

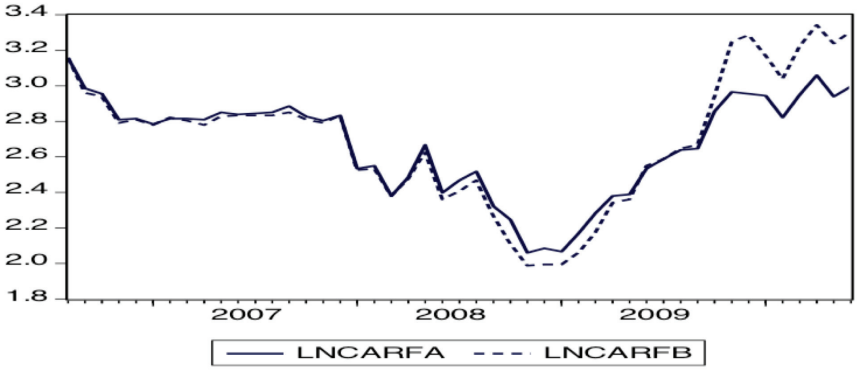


Table 7: Definitive Statistics of the Series

SERIES	Max.	Min.	Std. Deviation	Skewness	Kurtosis	Jarque-Bera (Prob)
LNCARFA	3.16	2.06	0.29	-0.61	2.36	3.69 (0.16)*
LNCARFB	3.34	1.99	0.37	-0.20	2.32	1.22 (0.54)*

Note: H_0 = Series distributed normally. *According to the 1% significance level, H_0 hypothesis cannot be rejected.

On taking a look at the descrip!ive statistics of CARFA and CARFB stock series in Table 7, we see that CARFB has more volatility than CARFA. According to the Jarque-Bera test statistic, the series shows a normal distribution on a significance level of 1%. The series is slightly negatively skewed and also flattened.

Table 8: Unit Root Test Results

STOCK	ADF UNIT ROOT TEST		PP UNIT ROOT TEST	
	LEVEL	1.LAG	LEVEL	1.LAG
LNCARFA	-0.97 (0) [.94]	-6.15 (0) [.00]	-1.02 (1) [.93]	-6.15 (1) [.00]
LNCARFB	-1.31 (0) [.87]	-7.36 (0) [.00]	-1.36 (3) [.86]	-7.33 (3) [.00]

CRITICAL TEST VALUES	
[a]1% significance level	-3.965363
[b]5% significance level	-3.413390
[c]10% significance level	-3.128731

Note 1: The numbers in parentheses Show the delay distansces chosen for ADF unit root test according to Schwarz Information Criteria and bandwidths determined according to Newey-West which uses Bartlett kernel for PP unit root test. The values in the square brackets Show the p-values of ADF and PP statistics.

According to the results of ADF and PP unit root test results given in Table 8, the logarithmic series is not constant on level values. However, once the first difference is taken for the series, it becomes constant.

Table 9: Johansen Cointegration Test Results

VARIABLE PAIR	Trace Testing	Probabilities	Max. Eigen Value Test	Probabilities
LNCARFA	18.16	0.053*	16.09	0.07*
LNCARFB	2.07	0.051	2.07	0.15

Note: While H_0: r = 0, r ≥ 1 hypothesis was tested with 1. row values, H_0: r = 1, r ≥ 2 hypothesis was tested with 2. row values. According to the *10% significance level, H_0 hypothesis is rejected.

According to the results of cointegration test, the hypothesis H_0 suggesting that no cointegration exists between LNCARFA and LNCARFB series on a significance level of 10% is rejected. These results show that there is a cointegration vector between the variable pairs.

Table 10: Long-Term Relationships from Error Correction Model

EQUATION 1: LNCARFA = 0.973 + 0.629 LNCARFB
EQUATION 2: LNCARFB = - 1.548+ 1.591 LNCARFA

Table 11: Short-Term Relationships from Error Correction Model

EQUATION 1: $\Delta CARFA = - 0.003 - 0.520\ \Delta CARFA_{t-1} + 0.466\ \Delta CARFB_{t-1} - 0.364\ EC_{t-1}$	(-1.80)
EQUATION 2: $\Delta CARFB = 0.002 - 0.812\ \Delta CARFA_{t-1} + 0.268\ \Delta CARFB_{t-1} - 0.314\ EC_{t-1}$	(-1.35)

Note: The values on the right of the table are t-statistics of EC_{t-1} which the error correction term.

Table 10 shows the long-term relationship obtained through the Johansen cointegration test. Table 11 shows to what extent the short-termed deviations as observed in the series acting in concert in the long term are corrected. Notation of the error correction term coefficient is found as "–" in equation 1 and equation 2. Consequently, deviations in the short-term within the series of LNCARFA - LNCARFB, wherein error correction mechanism operates and that act in concert in the long-term, are eliminated and the series converges towards one another.

4.3. General Information on Karabük Demir Çelik Fabrikaları A.Ş. and Test Results

Karabük Demir Çelik Fabrikaları A.Ş. started production in 1939 and it is the first integrated iron and steel plant in Turkey. Since 1995 when it was prioritized, the company has been carrying on with its commercial activities in the private sector and the company stocks started to be traded at the ISE in 1998. Its partnership structure is as follows since 18.02.2010;

Personnel-KDMRA 21.08%,

Members of Karabük chambers of industry, trade and craftsmen-KDMRB 10.48%,

Locals, Kardemir retired workers and cash public offering -KDMRD 68.44%

and the company carries on with the commercial activities as 100% accessible to the public.

As is shown in Figure 3, KDMRA, KDMRB and KDMRD stocks referred to herein act in concert in the long-term.

Figure 3: Monthly Logarithmic Price Change for KDMRA, KDMRB and KDMRD Stocks between September 1998 and June 2010.

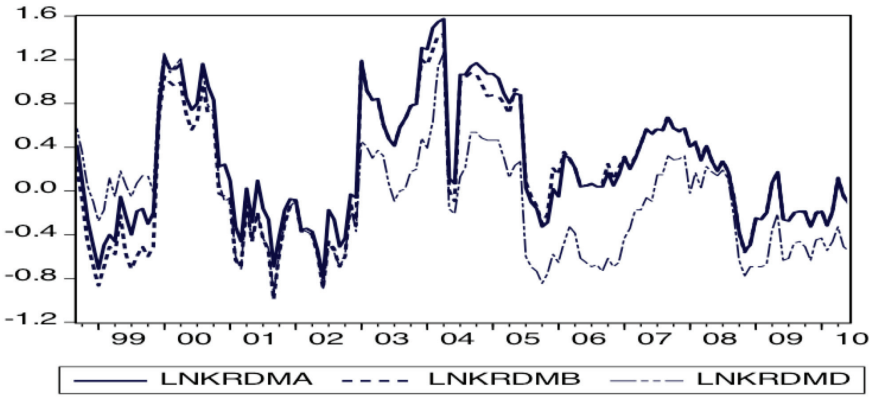


Table 12: Definitive Statistics of the Series

SERIES	Max.	Min.	Std. Deviation	Skewness	Kurtosis	Jarque-Bera (Prob)
LNKRDMA	1.57	-0.80	0.56	0.49	2.26	8.94 (0.011)*
LNKRDMB	1.44	-0.99	0.57	0.22	2.08	6.16 (0.04)*
LNKRDMD	1.27	-0.94	0.52	0.61	2.78	9.21 (0.010)*

Note: H_0 = Series distributed normally. *According to the 1% significance level, H_0 hypothesis cannot be rejected.

On taking a look at the descrip!ive statistics of KDMRA, KDMRB and KDMRD stock series indicated in Table 12, we see that the series are very close to one another in terms of volatility. According to the Jarque-Bera test statistics, the series shows a normal distribution on a significance level of 1%. The series is slightly negatively skewed and also flattened.

According to ADF and PP unit root test results given in Table 13, KDMRA and KDMRB stock series is constant with 10% significance level within 2 unit root tests.

Table 13: Unit Root Test Results

STOCK	ADF UNIT ROOT TEST		PP UNIT ROOT TEST	
	LEVEL	1. LAG	LEVEL	1. LAG
LNKRDMA	-3.14 (0) [.098]	-	-3.19 (2) [.089]	-
LNKRDMB	-3.24 (0) [.080]	-	-3.29 (0) [.072]	-
LNKRDMD	-3.43 (0) [.051]	-	-3.57 (4) [.036]	-

CRITICAL TEST VALUES	
[a]1% significance level	-3.965363
[b]5% significance level	-3.413390
[c]10% significance level	-3.128731

Note: The numbers in parentheses show the delay distances chosen for ADF unit root test according to Schwarz Information Criteria and bandwidths determined according to Newey-West which uses Bartlett kernel for PP unit root test. The values in the square brackets show the p-values of ADF and PP statistics.

Table 14: Johansen Cointegraiton Test Results

VARIABLE PAIR	Trace Testing	Probabilities	Max. Eigen Value Test	Probabilities
LNKRDMA	27.07	0.03*	16.56	0.12
LNKRDMB	10.51	0.11	10.51	0.11
LNKRDMA	11.92	0.06**	10.02	0.08**
LNKRDMD	1.89	0.20	1.89	0.20
LNKRDMB	13.00	0.04*	10.79	0.06**
LNKRDMD	2.22	0.16	2.22	0.16

Note: While H_0: $r = 0$, $r \geq 1$ hypothesis was tested with 1. row values, H_0: $r = 1$, $r \geq 2$ hypothesis was tested with 2. row values. According to the *5% and **10% significance level, H_0 hypothesis is rejected.

According to the cointegration test results given in Table 14, the hypothesis H_0 suggesting that no cointegration exists between LNKDMRA and LNKDMRB series on a significance level of 5%, and between LNKDMRA and LNKDMRD, LNKDMRB and LNKDMRD series on a significance level of 10% is rejected. These results show that there is a cointegration vector for each variable pairs.

Table 15: Long-Term Relationships from Error Correction Model

EQUATION 1:LNKRDMA = -0.12 + 2.24 LNKRDMB	DENKLEM 3: LNKRDMA = 0.20 - 0.37 LNKRDMD
EQUATION 2:LNKRDMB = -0.02 + 0.73 LNKRDMA	DENKLEM 4: LNKRDMD = 0.55 - 2.70 LNKRDMA
EQUATION 5: LNKRDMB = 0.11 – 0.58 LNKRDMD	
EQUATION 6: LNKRDMD = 0.20 - 1.73 LNKRDMB	

Table 16: Short-Term Relationships from Error Correction Model

EQUATION 1: ΔLNKRDMA = - 0.001 + 0.40 ΔLNKRDMA$_{t-1}$ - 0.31 ΔLNKRDMB$_{t-1}$ - 0.23 EC$_{t-1}$	(-3.29)
EQUATION 2: ΔLNKRDMB = 0.001 + 0.66 ΔLNKRDMA$_{t-1}$ - 0.55 ΔLNKRDMB$_{t-1}$ - 0.26 EC$_{t-1}$	(-3.13)
EQUATION 3: ΔLNKRDMA = - 0.003 + 0.37 ΔLNKRDMA$_{t-1}$ - 0.35 ΔLNKRDMD$_{t-1}$ - 0.11 EC$_{t-1}$	(-3.17)
EQUATION 4: ΔLNKRDMD = - 0.008 + 0.41 ΔLNKRDMA$_{t-1}$ - 0.37 ΔLNKRDMD$_{t-1}$ - 0.08 EC$_{t-1}$	(-2.65)
EQUATION 5: ΔLNKRDMB = - 0.002 + 0.28 ΔLNKRDMB$_{t-1}$ - 0.29 ΔLNKRDMD$_{t-1}$ - 0.10 EC$_{t-1}$	(-3.30)
EQUATION 6: ΔLNKRDMD = - 0.008 + 0.29 ΔLNKRDMB$_{t-1}$ - 0.26 ΔLNKRDMD$_{t-1}$ - 0.08 EC$_{t-1}$	(-2.83)

Note: The values on the right of the table are t-statistics of EC$_{t-1}$,which the error correction term.

Table 15 shows the long-term relationship obtained through the Johansen cointegration test. Table 16 shows to what extent the short-termed deviations as observed in the series acting in concert in the long term are corrected. Notation of the error correction term coefficient is found as "–" in all equations. Consequently, deviations in the short-term within the series of LNKRDMD-LNKRDMB, LNKRDMA-LNKRDMD and LNKRDMD-LNKRDMA, wherein error correction mechanism operates and that act in concert in the long-term, are eliminated and the series converges towards one another.

V. Conclusion

According to EPH, the security prices will give fundamental values thanks to rational traders. In case of deviations from the fundamental values in security prices due to irrational behaviors of the traders, the arbitragers that act rationally will cause the presence to return to its fundamental value. So, the presence prices always give the fundamental values. Recent studies, however, have proven that it is not necessarily always the case. It is defended in the studies that the arbitrage is limited in the markets depending on certain factors, which is supported by a set of various examples as well.

In this study, we examine whether the arbitrage is limited for the trading stocks at Istanbul Stock Exchange (ISE), which is the stock market in Turkey. For doing so, the stocks that mutually agree for merger and yet still continue to be traded at the ISE under two individual business names as before while also

showing activity as two different companies such as A and B have been considered. As a result of the research, no stocks under such conditions have been found. Afterwards, it has been resolved to examine whether the arbitrage is limited for the company stocks traded at different groups such as A, B and C at the ISE. By virtue of the study conducted, it has been determined that the stocks held by the 3 different companies are traded in groups.

Long-term relationship between the stocks held by the companies involved in the study and traded under different groups such as A, B and C has been examined by implementing graphical and econometric methods. In conclusion, it has been determined that the 3 companies involved in the study have a long-termed relationship between buying and shorting stocks in different groups and that deviations in the short term are corrected in a short time. According to these results, it can be said that the arbitrage is not limited for the ISE stocks, stocks owned by the companies trading at different groups such as A, B and C and that it operates rationally.

References

Barber B. M. and T. Odean, http://introduction.behaviouralfinance.net/ (Erişim Tarihi: 17.05.2009)

Barberis N. and R. H. Thaler, "A Survey of Behavioral Finance". İçinde; Editör: Richard H. Thaler, *Advances in Behavioral Finance*, Cilt II, Russell Sage Foundation, Princeton University Press, New York 2005.

De Long J. B., A. Shleifer, L. H. Summers, and R. J. Waldmann, "Noise Trader Risk in Financal Markets", *Journal of Political Economy,* XCVIII (4) 1990, 705.

Dickey, D. A. ve W. A. Fuller (1979), "Distribution of the Estimator for Autoregressive Time Series with a Unit Root", Journal of the American Statistical Association, 74, 427-431.

Dickey, D. A. ve W. A. Fuller (1981), "Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root", Econometrica, 49, 1057-1072.

Enders W. (1995), Applied Econometric Time Series, Jonh Wiles and Sons, Canada.

Engle, R. F. ve C. W. J. Granger (1987), "Co-integration and Error Correction: Representation, Estimation, and Testing", Econometrica, 55, 251-276.

Fischer Black, "Noise", *The Journal Finance,* XLI (3), 1986, 529-535.

Frankel R. and C. M.C. Lee, 1998, Accounting valuation, market expectation, and cross-sectional stock returns, *Journal of Accounting and Economics* 9, 195-228.

Froot K. A. and E. M. Dabora, "How Are Stock Prices Affected By The Location of Trade?", Journal of Financial Economics, LIII (2), 1999, 193.

Gujarati D. N. (1995), Basic Econometrics, McGraw-Hill, Third Edition, New York.

Harris L, Gurel E. 1986. Price and Volume Effects Associated With Changes in the S&P 500 List: New Evidence For The Existence Of Price Pressures. *Journal of Finance.* 41, 815-29.

http://www.imkb.gov.tr/Data/StocksData.aspx (Erişim Tarihi: 06.12.2010)

Johansen S. (1995), Likelihood-Based Inference in Cointegrated Vector Autoregressive Models, Oxford University Press, New York.

Johansen S. and K. Juselius (1990), "Maximum Likelihood Estimation and Inference on Cointegration- with Applications to the Demand for Money," Oxford Bulletin of Economics and Statistics, 52 (2), 169–210.

Johansen, S. (1988), "Statistical Analysis of Cointegration Vectors", Journal of Economic Dynamics and Control, 12, 231-254.

Lamount O. A. and R. H. Thaler, "Can the Market Add and Subtract? Mispricing in Tech Stock Cave-Outs", Journal of Political Economy, 111 (2), 2003, 227-268

MacKinnon J. (1991), "Critical Values for Cointegration Tests", In: Engle R. and C. Granger (eds) Long-Run Economic Relationships: Readings in Cointegration, Oxford University Press, Oxford, 267–276.

Maddala G.S., I. Kim,(1998) Unit Roots, Cointegration, and Structural Change, Cambridge University Press, Cambridge, UK.

Merton R. 1987. A Simple Model of Capital Market Equilibrium With Incomplete Information. Journal of Finance 42, 483-510

Newey W. and K. West (1987), "A Simple Positive Semi Definite, Heteroskedasticity and Autocorrelation Consistent Covariance Matrix", Econometrica, 55, 703-708.

Öztürk N. (2001), "Finansal Küreselleşmenin İktisat Politikalarına Etkisi ve Türkiye", (Basılmamış Doktora Tezi), Marmara Üniversitesi, Sosyal Bilimler Enstitüsü.

Phillips, P. C. B. and P. Pierre (1988), "Testing for Unit Roots in Time Series Regression", Biometrika, 75, 335-346.

Rosenthal L and C. Young 1990. The seemingly anomalous price behavior of Royal Dutch/Shell and Unilever N.V./PLC. *Journal of Financial Economics.* 26, 123-41.

Schwert, G. W. (1989), "Tests for Unit Roots: A Monte Carlo Investigation", Journal of Business and Economic Statistics, 7, 147-160.

Shleifer A. 1986. Do Demand Curves For Stocks Slope Down? *Journal of Finance,* 41, 579-90.

Shleifer A., *Inefficient Markets, An Introduction to Behavioral Finance*, Oxford University Press, New York 2000.

Tarı R. (2009), Ekonometri, 6. Baskı, Kocaeli Üniversitesi Yayını.

Wei K.C.J. and J. Zhang, 2006, The Limits of Arbitrage: Evidence from Fundamental Value-to-Price Trading Strategies, Working paper, Hong Kong University of Science and Technology.