

DOES THE TUNISIAN STOCK MARKET OVERREACT?

Fatma Hammami Dhouib^{1,3} and Ezzeddine Abaoub^{2,3}

¹*Doctorante en Sciences de Gestion, Faculté des Sciences
économiques et de Gestion, Université de Sfax – Tunisie*

²*Professeur Agrégé en Sciences de Gestion, Faculté des Sciences
Economiques et de Gestion, Université Elmanar de Tunis – Tunisie*

³*Laboratoire de Finance, de Comptabilité et d'Intermédiations Financière
(LAFICOIF) à la Faculté des Sciences Economiques et de Gestion,
Université Elmanar de Tunis – Tunisie*

Corresponding author: *hammami_fatma@yahoo.fr; abaoub.ezzeddine@wanadoo.tn*

ABSTRACT

Research in experimental financial markets suggests that most people tend to overreact to unexpected, striking, and more recent news, and underreact to ordinary or non desirable new events. Many researchers document, as a result that, if one of these behavioral designs exist, then stock prices will follow a mean-reversion phenomenon due to investor's overreaction, and a momentum behavior due to investor's underreaction. This study investigates if such behavior affects stock prices on the Tunisian Stock Market. In other words, we tend to discover the eventual existence of return mean-reversion and/or momentum behavior on the Tunisian Stock Market over the period between January 1997 and December 2005. For this purpose, we have applied a contrarian strategy, which consists of buying the previous (12, 18, 24 and 36 months) loser portfolio and selling the past winner portfolio. Our results point out that, over periods of 18, 24 and 36 months, stock returns exhibit statistically significant mean-reversion phenomenon, while, over 12 months periods, stock returns present significant momentum behavior. This means that stock prices are predictable on the basis of their historical recordings without using any accounting data, in contrast to the weak-form efficient market hypothesis.

Keywords: behavioral finance, overreaction, underreaction, contrarian strategy, momentum strategy, Tunisian Stock Market

INTRODUCTION

Efficient Market Hypothesis (EMH) requires that security prices reflect instantaneously fully all available relevant information (Fama, 1970). Therefore, it is impossible for any investor to beat the market or to generate abnormal returns basing on the historical recording of stocks. As a result, there was widespread consensus among financial economists that stock returns were unpredictable. Unpredictability has been seeing as a direct consequence of the EMH (see Figure 10 in appendix).

However, this consensus started to be revised after the works of DeBondt and Thaler (1985), Fama and French (1988), Poterba and Summers (1988), and Jegadeesh and Titman (1993) who document several statistical evidences that past returns are helpful to predict future returns. They rely on the fact that stock returns exhibit negative autocorrelations over long-holding-periods (DeBondt & Thaler, 1985), and positive autocorrelations over short-holding-periods (Jegadeesh & Titman, 1993).

The idea of negative return autocorrelations over time comes from the price overreaction phenomenon following the arrival of fundamental news (overestimation of news; see Figure 11 in appendix).¹ Then, if prices overreact, DeBondt and Thaler (1985) advance that prices exhibit the presence of two distinct and inverse phenomenons that occur simultaneously. In a first time, stocks are pushed beyond their fundamental values. After this first over (under) evaluation, and in a second time, when the market perceives the misevaluation of stocks in relation to their fundamental values, prices will be adjusted reciprocally showing a mean-reversion of prices, from where the negative autocorrelation of returns over time. In other words, the overreaction hypothesis predicts, first, that stocks that present high abnormal returns (named winners) experience an inverse progression over time, that is to say abnormal low returns, and vice versa, secondly, the more extreme the initial price movement, the greater will be the subsequent adjustment (DeBondt & Thaler, 1985; 1987). This phenomenon has been discovered by several studies at long-temporal-horizons as well as at short ones. For instance, DeBondt and Thaler (1985, 1987) and Chopra et al. (1992), find that it is a phenomenon that characterizes the long-term stock prices behavior (from 3 to 5 years), while, Jegadeesh (1990), Lehmann (1990), Conrad, Gulktekin and Kaul (1997), and Assoé and Sy (2004) discover a return reversion on relatively intermediate and short horizons (from 1 to 6 months).

¹ Behavioral finance document that the price overreaction is due to the excessive reaction of (ir)rational individuals, while the supporters of the EMH suppose that it is the result of apparition of additional factors of risks.

On the other hand, the insight of positive returns autocorrelations over time originates from the price underreaction phenomenon at the appearance of fundamental news (underestimation of news; see Figure 12 in appendix). Jegadeesh and Titman (1993, 2001) document that price does not integrate immediately the good or the bad news announced as foreseen by the EMH. Indeed, stocks that generate high performances in such year will continue to produce also positive returns on the following year. In the same manner, stocks that have experienced bad performances on a year would not redress the situation the following year, from where the occurrence of positive returns autocorrelations over time (Jegadeesh & Titman, 1993; 2001). Besides Jegadeesh and Titman (1993; 2001), many other researchers, among others, Rouwenhorst (1998, 1999), Chan, Jegadeesh and Lakonishok (2000), Grundy and Martin (2001), Lewellen (2002), Patro and Wu (2004), argue that the stock return behavior exhibits a momentum phenomenon, where, in average, past winners continue to outperform past losers, speciously, over intermediate and short term horizons (3 to 12 months).

As a consequence, an extensive body of research documents that, if these anomalies exist on stock markets, then ex-ante stock returns are predictable on the basis of their ex-post recording, in contradiction to the EMH.² Currently, there seems to be wide acceptance of the idea that returns are, to some extent, predictable, see for instance Cochrane (2001), Lewellen (2004), Ang and Bekaert (2005), and Campbell and Yogo (2006), etc. There is also extensive evidence that active investment strategies exploiting these two patterns of predictability generate significant abnormal returns. Then, given such time series patterns in cross-sectional stock returns, one can formulate two profitable portfolio-investment-strategies: contrarian strategy, based on the price reversals phenomenon, and momentum strategy based on the price continuation phenomenon.

Under the contrarian strategy, past loser-stocks are bought and past winners are sold. And under the momentum strategy, past winners are bought and past losers are sold. Considerable evidence proves that both contrarian and momentum investment strategies, apparently contradictory, produce generally statistically, and sometimes economically significant excess returns. Indeed, the degree of statistic and economic profitability of these investment strategies differs from one study to another according to the temporal horizon used (short, medium, or long term horizons) and to the development level of the selected countries.

² Our paper parts from this idea to test the stock return predictability of the Tunisian Stock Market.

The purpose of this paper is to investigate the nature of the phenomenon characterizing the behavior of the Tunisian Stock Market prices. We will concentrate on an empirical test of the over-reaction hypothesis of price behavior. We explore if stock prices follow a mean reversion or a momentum behavior or simply a random-walk phenomenon over horizons from one year to three years. For this reason, we have applied a contrarian strategy,³ and we have tested the following two hypotheses:

- H₁: If significant extreme movements in stock prices will be followed by subsequent significant extreme price movements in the opposite direction, then stock returns exhibit a mean reversion phenomenon.
- H₂: If significant extreme movements in stock prices will be followed by subsequent significant price movements in the same direction, then stock returns exhibit a momentum phenomenon.
- H₃: If neither mean-reversion nor momentum phenomena characterizes clearly and significantly price behavior of the Tunisian Stock Market, then stock returns exhibit simply a random-walk phenomenon.

Briefly, the empirical validation of the first two hypotheses may imply a violation of the weak-form of the EMH, in so far as, if stock prices systematically overshoot (or undershoot), then their reversal (or their momentum) should be predictable alone from past return data, with no use of any accounting data such as earnings. While under the third hypothesis, the EMH cannot be rejected.

The remainder of the paper is organized as follows. The next section describes the data and the methodology used to construct the winner, loser, and contrarian portfolios (called also arbitrage portfolio or zero-investment portfolios), as well as the statistical test used to measure the significance of the results. The following section III presents the main results and their interpretation. The article ends, in a last section with a brief summary of conclusions.

³ We apply the same methodology used by DeBondt and Thaler (1985).

THE OVER-REACTION AND UNDERREACTION HYPOTHESIS: EMPIRICAL TESTS

The tests involved in this study assess the extent to which systematic nonzero residual return behavior in the period after portfolio formation ($t > 0$) is associated with systematic residual returns in the pre-formation months ($t < 0$) of portfolios. We will focus on stocks that have experienced either extreme capital gains or extreme losses over different periods from 12 months up to three years. In other words, "winner" (W) and "loser" (L) portfolios are formed conditional upon past excess returns, rather than some firm-generated informational variable such as earnings.

The EMH predicts that:

$$E(\hat{U}_{W,t} | F_{t-1}) = E(\hat{U}_{L,t} | F_{t-1}) = 0 \quad (1)$$

Where F_{t-1} represents the complete set of information at time $t - 1$, and $\hat{U}_{W,t}$ and $\hat{U}_{L,t}$ represents the residual returns, respectively of the winner and loser portfolio. On the other hand, the price overreaction (or the mean-reversion) hypothesis suggests that $E(\hat{U}_{L,t} | F_{t-1}) > 0$ and $E(\hat{U}_{W,t} | F_{t-1}) < 0$, therefore:

$$E(\hat{U}_{L,t} | F_{t-1}) - E(\hat{U}_{W,t} | F_{t-1}) > 0 \quad (2)$$

Therefore, the underreaction (or the momentum) suggests that:

$$E(\hat{U}_{L,t} | F_{t-1}) - E(\hat{U}_{W,t} | F_{t-1}) < 0 \quad (3)$$

Data as well as the basic research methodology used in the setting of this paper are described in the following subsections.

Data

Monthly average of enclosure prices data⁴ for 30 stocks listed on the Tunisian stock exchange (BVMT)⁵ are used for the period between January 1997 and

⁴ Similar to DeBondt and Thaler (1985), the choice to use a monthly database is in part justified by our concern to avoid certain measurement problems that have received much attention in the literature. Most of the problems arise with the use of daily data, both with respect to the risk and return variables. They include, among others, the "bid-ask" effect and the consequences of infrequent trading.

December 2005.⁶ In fact, it is important to note that the monthly return of stock j at time t is calculated as follows:

$$R_{j,t} = \frac{P_{j,t} + Div_{j,t} - P_{j,t-1}}{P_{j,t-1}} \quad (4)$$

Where $P_{j,t}$ is the average closure price of stock j over month t ;
 $P_{j,t-1}$ is the average closure prices j over month $t - 1$;
 $Div_{j,t}$ is the dividend distributed by stock j for month t

Methodology

In this section, we describe our simple strategy. Most of this section is taken from DeBondt and Thaler (1985). The empirical test methodology consists to follow the subsequent steps in order to form the winner and loser portfolios. Then, inevitably, it is necessary to measure the degree of statistical significance of the founded results.

Winner and loser portfolio construction procedures

This empirical study can be achieved using three types of return residuals: market-adjusted excess returns, market model residuals; and excess returns that are measured relative to the Sharp-Lintner version of the CAPM (DeBondt & Thaler, 1985). It turns out whichever of the three types of residuals are used? They affirm that the results of the empirical analysis are similar and that choice does not affect the main conclusions. Therefore, as maid DeBondt and Thaler (1985), we will only report the results based on market-adjusted excess returns.

Consequently, to achieve the performance test of the winner and loser portfolios formed over a period of 12 months,⁷ for example, we will pass by the following steps:

⁵ We choose only 30 securities listed on the Tunisian stock market because there are not enough stocks traded on our market place over 1997–2005 study period. The list of stocks on which we will apply the tests of mean-reversion and momentum phenomenon includes securities of all sectors.

⁶ On the list of daily closure prices of stocks traded on the BVMT, one calculated the monthly average closure prices of each of the thirty securities.

⁷ In order to facilitate the comprehension of the procedure used to form the winner and loser portfolios, we have chosen to present the case of formation portfolio over periods of 12 months.

- i. The first step consists to calculate – for every stock j on the tape with at least 12 months of return data, without any missing values in between – the residual return ($\hat{U}_{j,t}$). It is hence estimated by:

$$\hat{U}_{j,t} = R_{j,t} - R_{m,t} \quad (5)$$

where $R_{j,t}$ is the return of stock j at time t , and $R_{m,t}$ is the arithmetic average rate of return of all stocks traded in the market at time t .

We remark that there is no risk adjustment except for movements of the market as a whole and the adjustment is identical for all stocks.

This procedure is repeated eight times⁸ starting in January 1997, January 1998, up to January 2004.

- ii. For every stock j , starting in December 1997 (month 12 is the portfolio formation date; $t = 0$), we compute the cumulative excess returns for the prior 12 months (the portfolio formation period is from month 1 up to month 12) as:

$$Cum \hat{U}_j = \sum_{t=11}^{t=0} \hat{U}_{j,t} \quad (6)$$

- iii. On each of the eight relevant portfolio formation dates (December 1997, December 1998 up to December 2004), the $Cum \hat{U}_j$'s are ranked in an ascending order and portfolios are formed. The top 40% (12 securities) or 20% (6 securities) constitutes the winner portfolio (W); the bottom 40% or 20% of stocks is assigned to the loser portfolio (L).⁹ Thus, the portfolios are formed conditional upon excess return behavior prior to $t = 0$, the portfolio formation date.

⁸ Eight is the number of the non-overlapping replications (noted by N) for a contrarian strategy applied for a formation period of 12 months over the period between January 1997 and December 2005. It is useful to note that the number of independent replications vary inversely with the chosen length of the formation period. For instance – on the research predefined period, from January 1997 to December 2005, we have 108 months – for portfolio formed on the 12 prior months, we will obtain 8 independent replications, whereas if we take a formation period of 36 months we will have only two independent replications.

⁹ The choice of 40% and 20% of the listed stocks is arbitrary.

- iv. For each portfolios in each of the eight non-overlapping 12-month periods ($n = 1, \dots, N$; $N = 8$), starting in January 1998 (month 13, the "starting month") and up to December 2005, we now compute the cumulative average residual returns (CAR) of all securities in the portfolio, for the next 12 months (the "test period" begin from month 13 up to month 24), i.e., from $t = 1$ through $t = 12$. We find $CAR_{W,n,t}$ and $CAR_{L,n,t}$. If a security's return is missing in a month subsequent to portfolio formation, then, from that moment on, the stock is permanently dropped from the portfolio and the CAR will be an average of the available residual returns. Thus, whenever a stock drops out, the calculations involve an implicit rebalancing.
- v. Using the CAR's from all eight test periods, average CAR's are computed for both winner and loser portfolios and at each month between $t = 1$ and $t = 12$. They are denoted $ACAR_{W,t}$ and $ACAR_{L,t}$, respectively. Explicitly, they was calculate as follows:

$$ACAR_{W,t} = \sum_{n=1}^{n=N} CAR_{W,n,t} / N \quad (7)$$

$$ACAR_{L,t} = \sum_{n=1}^{n=N} CAR_{L,n,t} / N \quad (8)$$

The overreaction hypothesis predicts that, $ACAR_{W,t} < 0$ and $ACAR_{L,t} > 0$, so that, by implication, $[ACAR_{L,t} - ACAR_{W,t}] > 0$. On the other hand, the under-reaction hypothesis anticipate that $ACAR_{W,t} > 0$ and $ACAR_{L,t} < 0$, in such a way that $[ACAR_{L,t} - ACAR_{W,t}] < 0$.

Therefore, one needs to calculate, in a final step, the average cumulative abnormal return of the contrarian portfolio, noted by $ACAR_{C,t}$. It equals, for each month t into the test period, to the difference of the average cumulative abnormal return between both loser and winner portfolios, so as to:

$$ACAR_{C,t} = ACAR_{L,t} - ACAR_{W,t} \quad (9)$$

Statistical significance level of the results

Primarily, in order to assess whether, at any time t , there is indeed a statistically significant difference in investment performance, we need a pooled estimate of the population variance in CAR_t ,

$$S_t^2 = \left[\sum_{n=1}^N (CAR_{W,n,t} - ACAR_{W,t})^2 + \sum_{n=1}^N (CAR_{L,n,t} - ACAR_{L,t})^2 \right] / 2(N-1) \quad (10)$$

With two samples of equal size N , the variance of the difference of sample means equals $2S_t^2/N$ and the t -statistic is therefore:

$$T_t = [ACAR_{L,t} - ACAR_{W,t}] / \sqrt{2S_t^2/N} \quad (11)$$

Relevant t -statistics can be found for each of the 12 post-formation months but they do not represent independent evidence.

Secondly, in the goal to judge, for any month t , the average residual return makes a contribution to either $ACAR_{W,t}$ or $ACAR_{L,t}$, we can test whether it is significantly different from zero. The sample standard deviation of the winner portfolio is equal to

$$s_{t,W} = \sqrt{\sum_{n=1}^N (AR_{W,n,t} - AR_{W,t})^2 / N - 1} \quad (12)$$

In the same manner, the standard deviation of the loser portfolio is equal to:

$$s_{t,L} = \sqrt{\sum_{n=1}^N (AR_{L,n,t} - AR_{L,t})^2 / N - 1} \quad (13)$$

Since s_{tW}/\sqrt{N} represents the sample estimate of the standard error of $AR_{w,t}$, the t -statistic equals:

$$T_{tW} = AR_{W,t} / (s_{tW}/\sqrt{N}) \quad (14)$$

In the same way, because s_{tL}/\sqrt{N} represents the sample estimates of the standard error of $AR_{L,t}$, the t -statistic equals:

$$T_{tL} = AR_{L,t} / (s_{tL}/\sqrt{N}) \quad (15)$$

THE OVER-REACTION AND UNDER-REACTION HYPOTHESIS: EMPIRICAL RESULTS

It is important to recall that, if the contrarian portfolio generates positive (negative) and significant abnormal returns over the test period, we say that the stock prices follow a mean-reversion (momentum) phenomenon. Hence, the most profitable manner for such investor to generate abnormal returns consists to apply a contrarian (momentum)¹⁰ strategy.

Finally, if the contrarian portfolio generates weak and non significant return values, we say simply that stock prices follow a random walk phenomenon.

We have established eight different contrarian strategies on the Tunisian Stock Market in order to discover the nature of the behavior underlying the fluctuation of stock prices. These tests differ both in terms of the length of the formation/hold periods and in terms of the number of stocks in the constructed portfolios. The results of all these tests are presented in details by Tables 1 to 4 and through Figures 1 to 8.

Throwing a general view on Tables 1 to 4, one can notices, that all results confirm the overreaction hypothesis since the contrarian portfolios, during the period of test, generates positive abnormal returns, except the tests done on a 12 month formation/test period. These results are generally compatible to results found by DeBondt and Thaler (1985) in American stock markets.

We observe also that the contrarian strategies playing on the 6 extreme stocks generate more important and significant profits than strategies playing on the 12 extreme stocks. For this reason, we have choosen to report in the Figures showing the tendencies of winner and loser portfolios over the test periods, just the results produced by contrarian strategies basing upon the past 6 extreme stocks. But, in order to conceive the intensity of the abnormal return differences compared with strategies based on 12 extreme stocks, we have report on the Figures 2, 4, 6 and 8, the evolutions of abnormal returns produced by contrarian strategies based on both 6 and 12 stocks.

In addition, from the following tables, the general remark to make is that the cumulative abnormal returns generated by both loser and winner portfolios at the end of the different periods of formation are in increasing function of the

¹⁰ The momentum strategy consists, as opposed to the contrarian strategy, to buy the previous winners and to sell the past losers. Therefore, the arbitrage portfolio return will be equals to winner portfolio return minus loser portfolio return.

formation horizon length. Analogically, the subsequent adjustments must be also the same way, what is the case, under some reserves.¹¹

In the following paragraphs, we have interpret in a detailed manner the results generated by each of the eight tests defined above. We start with the presentation and the interpretation of the test of the cumulative return evolutions (in excess of the market) of the different portfolios formed and held over a period of 36 months until lead finally to the test accomplished on a period of 12 months.

Table 1
Evolutions of Average (Market-Adjusted) Cumulative Returns of the Loser, Winner and Contrarian Portfolios at the End of a 36 months Formation Periods and 1, 3, 6, 9, 12, 13, 18, 20, 24, 25, and 36 Months into the Test Periods

No. of replications and length of the formation	No. of extreme stocks in the portfolio	Nature of the portfolios	ACAR (<i>t</i> -statistics) at the end of formation periods	ACAR (<i>t</i> -statistics) into the test periods				
				Number of months into the test periods				
				1	12	24	25	36
2 Thirty-six-month periods	12	Loser	-0.435	-0.001	0.059	0.027	0.034	0.047
		Winner	0.418	0.007	0.018	-0.033	-0.029	-0.070
		Loser-Winner (<i>t</i> -statistics)	-0.854	-0.008	0.042	0.060	0.063	0.117
	6	Loser	-0.627	0.005	0.181	0.173	0.185	0.258
		Winner	0.579	0.029	0.088	-0.016	-0.013	-0.139
		Loser-Winner (<i>t</i> -statistics)	-1.206	-0.024	0.092	0.189	0.198	0.397
		(<i>t</i> -statistics)	(-4.80)	(-0.41)	(0.31)	(0.62)	(0.64)	(0.69)
		(<i>t</i> -statistics)	(-7.73)	(-0.46)	(0.44)	(1.72)	(1.70)	(3.00)

For the test done on a period of 36 months with 20% extreme stocks (6 stocks), the loser portfolio continue to generate negative excess-market returns until the 8th month. On the other hand, the winner portfolio continues to produce positive excess-market-returns until the 23rd month as shown in the following graphic.

¹¹ One is going to see further that the exception touches portfolios constructed and held over 36 months since they are dominated by those formed and detained during 24 months periods.

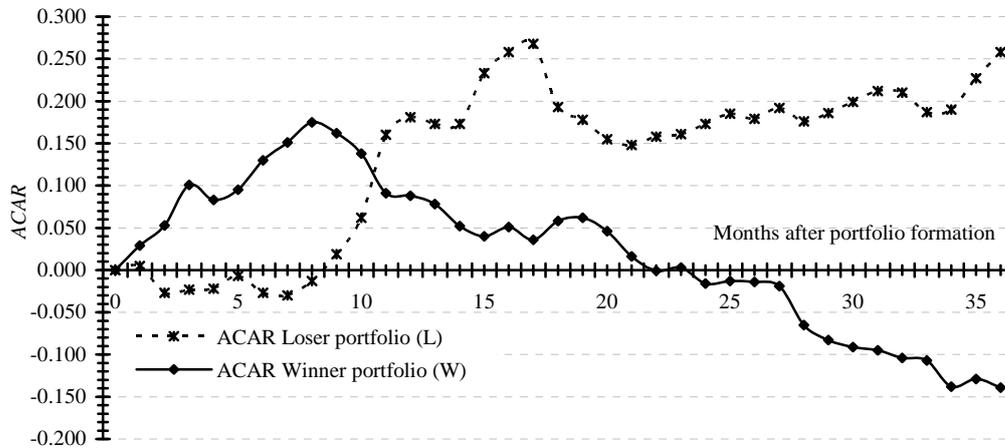


Figure 1. Evolutions of average (market-adjusted) cumulative returns of the loser and winner portfolios (6 extreme stocks) during a test period of 36 months

As a result, one observes that the mean-reversion phenomenon begin to appear only from the 10th month (see Figure 2).¹² Besides, the poorest cumulative performance of the contrarian portfolio figures at the 8th month, it equals -18.8% (t -statistic: -1.98), and the highest cumulative performance is recorded at 36th month marking a return equals to 39.7% (t -statistic: 3.00).

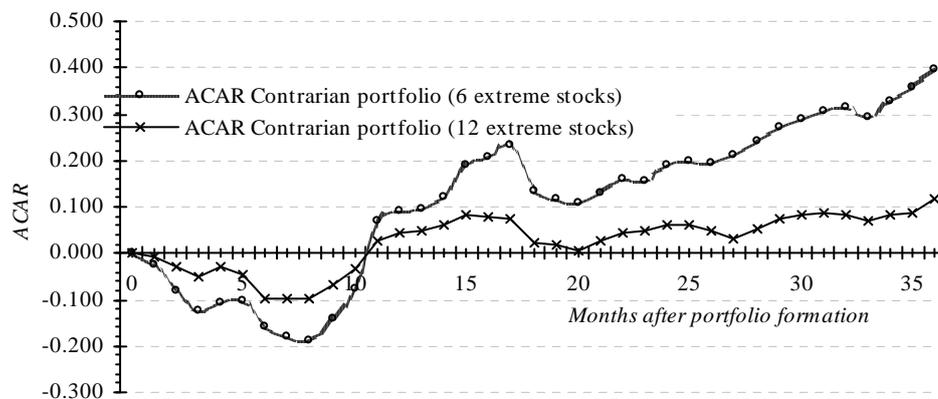


Figure 2. Evolutions of average (market-adjusted) cumulative returns of the Contrarian portfolios during a test period of 36 months

We can also add that, while the contrarian portfolio has recorded the poorest cumulative returns of -120.6% (t -statistic: -7.73) at the end of the

¹² This is identical for both contrarian portfolios formed upon 12 and 6 extreme stocks.

formation period, it come to adjust the situation over of the following same length period while marking significant cumulative positive returns at a level of 39.7% at 36th month. However, with 40% extreme stocks (12 stocks), the highest cumulative return through the test period is merely about 11.7% (t-statistic: 0.69) at 36th month.

The tests achieved over a formation/hold periods of 24 months point out either the empirical validation of the overreaction hypothesis.

Table 2
Evolutions of Average (Market-Adjusted) Cumulative Returns of the Loser, Winner and Contrarian Portfolios at the End of a 24 months Formation Periods and 1, 12, 13, 22 and 24 Months into the Test Periods

No. of replications and length of the formation	No. of extreme stocks in the portfolio	Nature of the portfolios	ACAR (t-statistics) at the end of formation periods	ACAR (t-statistics) into the test periods				
				Number of months into the test periods				
				1	12	13	22	24
3 Twenty-four month periods	12	Loser	-0.350	0.019	0.092	0.101	0.05	0.048
		Winner	0.356	-0.014	-0.089	-0.103	-0.086	-0.094
		Loser-Winner (t-statistics)	-0.706 (-7.34)	0.033 (1.34)	0.181 (2.37)	0.204 (2.76)	0.140 (2.03)	0.142 (1.79)
	6	Loser	-0.508	0.018	0.113	0.127	0.068	0.036
		Winner	0.356	-0.020	-0.145	-0.166	-0.172	-0.166
		Loser-Winner (t-statistics)	-1.055 (-21.73)	0.038 (1.16)	0.258 (1.78)	0.293 (2.01)	0.240 (2.10)	0.202 (1.51)

Specifically, although the loser portfolio has recorded negative returns at the level of -50.8% less than the market at the end of the period of formation, it tend to adjust the situation while recording positive values statistically significant during the test period. Symmetrically, the winner portfolio, that have recorded extreme positive return of 35.6% highest than the market at the end of the formation period, reverses completely the situation over the following 24 months marking negative values (see Figure 3).

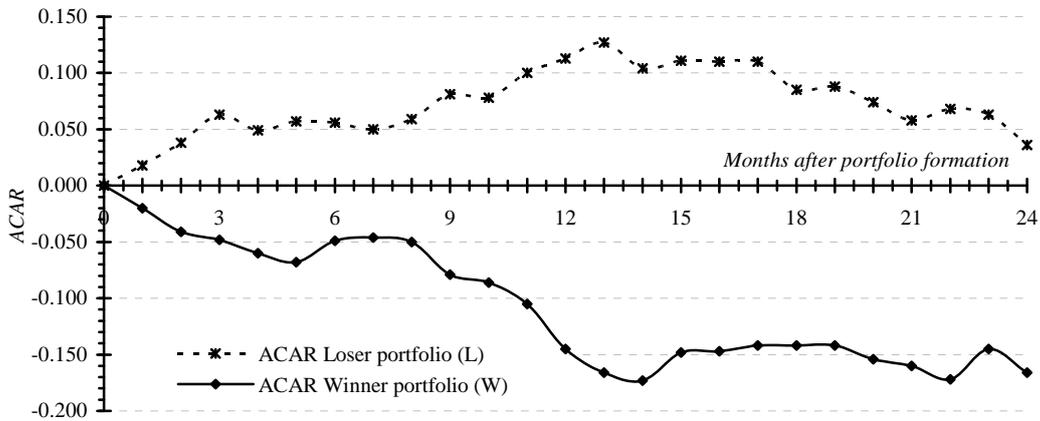


Figure 3. Evolutions of average cumulative market-adjusted returns of the loser and winner portfolios (6 extreme stocks) during a test period of 24 months

Consequently, the contrarian portfolio, which recorded negative returns of 105.5% (t -statistic: -21.73) at the end of the formation period, recover the position while marking positive returns above the test period as capturing an extreme value of 29.3% (t -statistic: 2.01) at the 13th month into the test period (Figure 4).

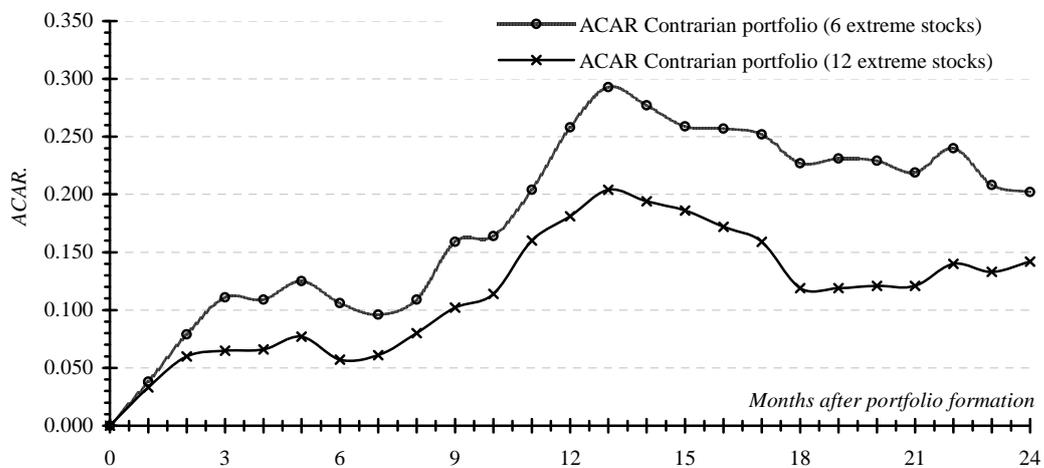


Figure 4. Evolutions of average abnormal-returns of the Contrarian portfolios during a test period of 24 months

The next test is accomplished over a non-overlapping periods of 18 months.

Table 3
 Evolutions of Average (Market-Adjusted) Cumulative Returns of the Loser, Winner and Contrarian Portfolios at the End of an 18 months Formation Periods and 1, 6, 12, 16, and 18 Months into the Test Periods

No. of replications and length of the formation	No. of extreme stocks in the portfolio	Nature of the portfolios	ACAR (<i>t</i> -statistics) at the end of formation periods	ACAR (<i>t</i> -statistics) into the test periods				
				Number of months into the test periods				
				1	6	12	16	18
5 Eighteen-month periods	12	Loser	-0.305	-0.010	-0.006	0.008	0.027	0.030
		Winner	0.321	0.000	-0.040	-0.029	-0.072	-0.066
		Loser-Winner	-0.626	-0.010	0.033	0.037	0.099	0.097
		(<i>t</i> -statistics)	(-10.53)	(-1.53)	(1.91)	(0.54)	(1.26)	(1.24)
	6	Loser	-0.450	-0.019	0.036	0.091	0.129	0.138
		Winner	0.499	0.011	-0.056	-0.057	-0.144	-0.136
Loser-Winner		-0.950	-0.031	0.091	0.148	0.273	0.274	
	(<i>t</i> -statistics)	(-13.05)	(-2.17)	(2.84)	(1.43)	(2.23)	(2.39)	

Like the tests done on a 36 and 24 month test periods, the examination of the test made on 18 months show an overreaction phenomenon insofar as losers and winners oppose their past positions while marking, respectively, positive and negative significant values into the test periods (Figure 5).

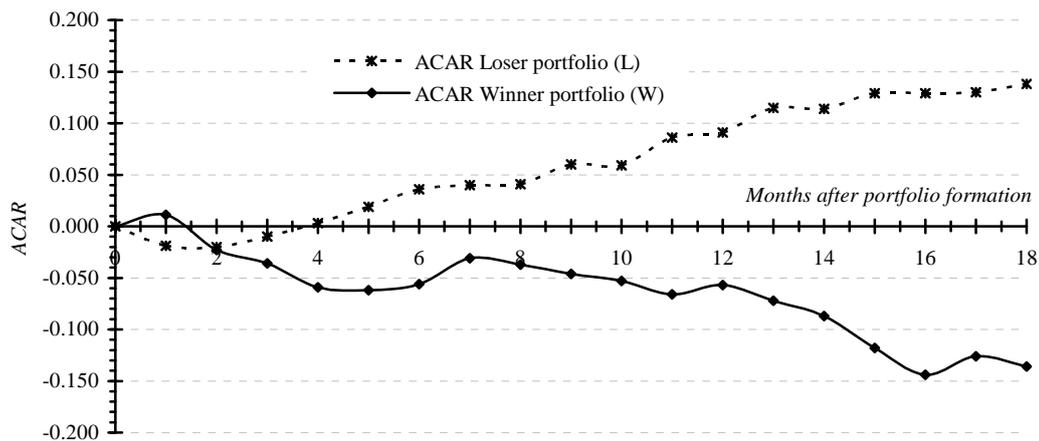


Figure 5. Evolutions of average market-adjusted returns of the loser and winner portfolios (6 extreme stocks) during a test period of 18 months

The contrarian portfolio formed in the base of the past 18-month-periods, begin to record positive returns from second month into the test period while reaching an extreme value of 27.4% (*t*-statistic: 2.39) at 18th month (see Figure 6).

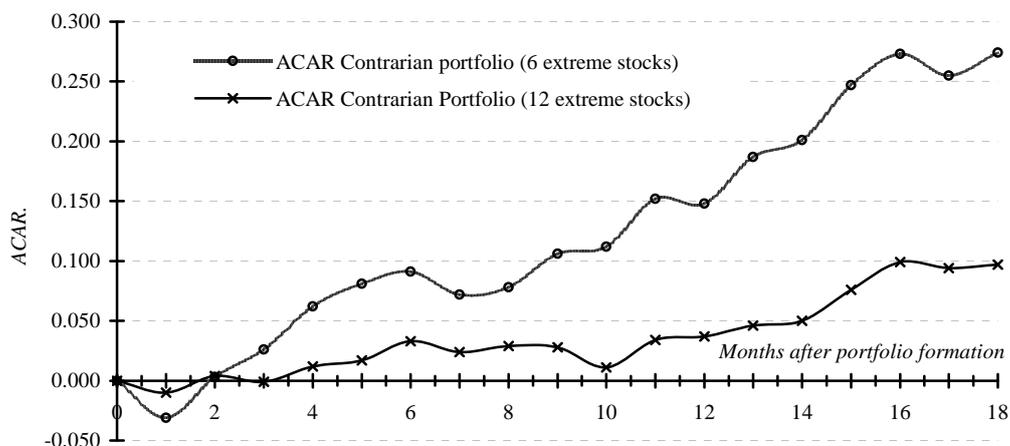


Figure 6. Evolutions of average (market-adjusted) cumulative returns of the Contrarian portfolios during a test period of 18 months

Nevertheless, although the positive returns recorded by the contrarian portfolio prove that prices follow an overreaction behavior, one can affirm the empirical validation of this hypothesis only for the test done with 6 extreme stocks, because of the non statistical significance of values found with 12 extreme stocks.

The subsequent test studies the return behavior over a period of 12 months.

Table 4
Evolutions of Average (Market-Adjusted) Cumulative Returns of the Loser, Winner and Contrarian Portfolios at the End of a 12 months Formation Periods and 1, 3, 7, 9, and 12 Months into the Test Periods

No. of replications and length of the formation	No. of extreme stocks in the portfolio	Nature of the portfolios	ACAR (t-statistics) at the end of formation periods	ACAR (t-statistics) into the test periods				
				Number of months into the test periods				
				1	3	7	9	12
8 Twelve-month periods	12	Loser	-0.246	-0.007	-0.016	-0.040	-0.033	-0.001
		Winner	0.238	0.007	0.024	0.027	0.014	-0.013
		Loser-Winner	-0.485	-0.014	-0.040	-0.067	-0.047	0.012
		(t-statistics)	(-10.82)	(-1.42)	(-2.10)	(-2.25)	(-1.17)	(0.24)
	6	Loser	-0.280	-0.006	0.002	-0.015	-0.003	0.049
		Winner	0.384	0.024	0.034	0.043	0.021	-0.025
		Loser-Winner	-0.664	-0.030	-0.032	-0.059	-0.024	0.075
		(t-statistics)	(-13.72)	-1.59	-1.16	(-1.54)	(-0.50)	(1.13)

The results of this test get the proof that, in the contrast of the previous tests, the portfolio returns does not follow a mean-reversion phenomenon for a portfolios composition of 12 extreme stocks. Then, portfolios follow rather a momentum behavior insofar as, the past extreme winner portfolio keep its position over the following 12 months, and in the same way, the past extreme loser portfolio do not adjust the position so as it continues to submit negative returns. As a result, as the winner and loser portfolios record a continuity of returns in the same direction over the test period of 12 months, it is advisable for such investor to adopt a momentum strategy in order to produce abnormal positive returns. But, for the portfolios composition of 6 extreme stocks, there is reversion of past portfolio positions merely at the beginning of the 4th quarter of the 12 month test period. In this case, the contrarian portfolios reach merely a return level of 7.5% (t -statistic: 1.13) (Figure 7).

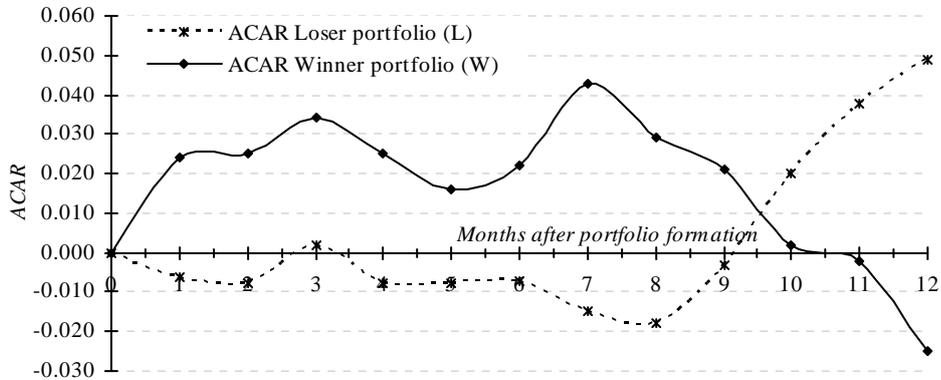


Figure 7. Evolutions of average excess-market-returns of the loser and winner portfolios (6 extreme stocks) during a test period of 12 months

Then, the momentum hypothesis cannot be rejected for the tests done on a 12 month formation/hold periods especially for a portfolio compositions of 12 stocks where contrarian portfolios generates negative values sometimes significant over the 12 month test periods. However, according to the results generated by the strategies made on the basis of 6 extreme stocks, neither the mean-reversion nor the momentum phenomenon is statistically significant, so, the random walk return hypothesis cannot be rejected in this case.

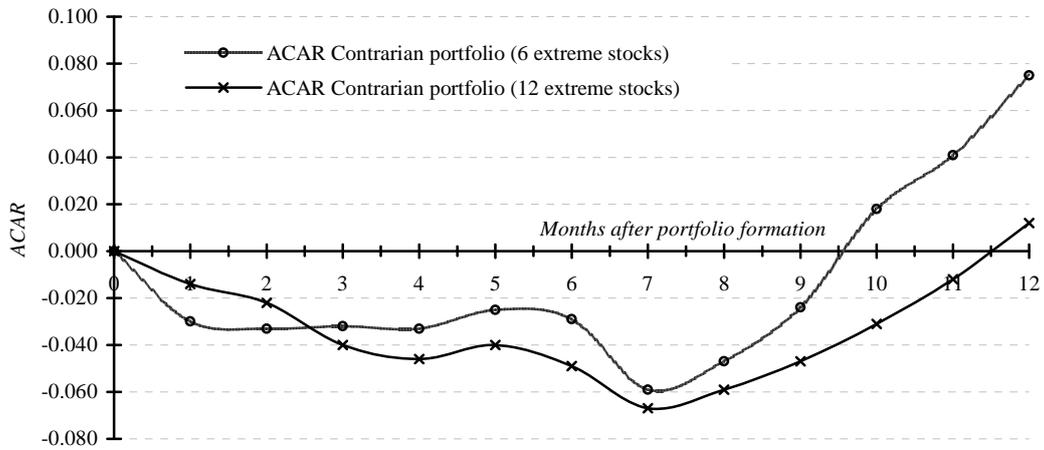


Figure 8. Evolutions of average (market-adjusted) cumulative returns of the contrarian portfolios during a test period of 12 months

In order to conceive the length of the period in which appears the most intensive overreaction phenomenon, we have reported in the Figure 9 the tendencies of the average cumulative returns owned by each of the four constructed contrarian portfolios, which contain six extreme stocks.

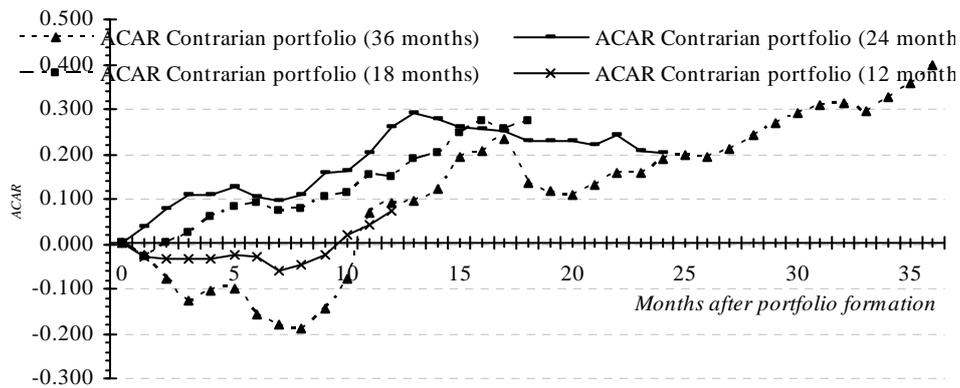


Figure 9. Evolutions of average (market-adjusted) cumulative returns of the Contrarian portfolios during the different length test periods

It is clear that up to the first 15 months, the 24 months contrarian strategies dominate all other strategies insofar as, the contrarian portfolios records the most important cumulative returns. For the temporal intervals between 16 and 18 months into the test periods, it is the 18 months contrarian strategies which receives the most superior cumulative returns. Then, from 19th month to 24th month, the 24 month contrarian portfolio rejoins the dominance situation. Nevertheless, among all these four contrarian strategies, the most important cumulative return is reached by the contrarian portfolio constructed over 36 month periods at the final month (39.7%).

In summary, we found that the overreaction phenomenon characterizes the behavior of prices on the Tunisian stock market over long terms (from 18 months to 36 months). For the 12 month periods, we observe a momentum phenomenon for the portfolios compositions of 40% extreme stocks, while we found that the EMH of price random walk cannot be rejected for the portfolios compositions of 20% extreme stocks. In general, all these results confirm the results founded by DeBondt and Thaler (1985). However, it is important to discover what are the sources behind these return over/underreaction phenomenons¹³.

IMPLICATIONS FOR OTHER EMPIRICAL RESEARCH

The principle goal of this study was to discover the nature of the phenomenon characterizing the behavior of return fluctuation of stocks over time on the Tunisian Stock Market in order to discover the possibility of their predictability. Nevertheless, we did not study the reasons of generated phenomenon. The possible reasons evoked in the literature are of two types, the behavioral (non-rational) explanations, and fundamental (or rational) explanations.

The behavioral explanations are specifically linked to the irrational behaviors among investors due to the appearance of psychological bias when they process new information. In fact, DeBondt and Thaler (1985) assign the long-term overreaction phenomenon to the overreaction of investors to recent information. They leave from this idea to discover the anomaly of prices overreaction. They explain also that investors overvalue in a first stage the recent information to the detriment of the past one, therefore, they are going to buy attractive securities more and to sell more non promising stocks. Following this first reaction of investors, prices move away from their fundamental values. At this level appear portfolios, so-called losers, those that the unfavorable news has

¹³ This point is the object of an ulterior research on sources underlying the apparition of the over and underreaction phenomenon.

been overvalued, and portfolios called winners, whose initial news was favorable, but also overestimated. Considering a long term period, investors, conscious of the initial overestimation of prices, are going to adopt arbitrage strategies permitting to conduct prices toward their fundamental values. Selling the overvalued winners, they are going to induce a downfall of prices, and buying the undervalued losers, they tend to generate a rise of prices, until leading the two mispriced stocks toward their intrinsic value. From this fact appear the price mean-reversion phenomenon. DeBondt and Thaler (1985) attributes as a result the price overreaction phenomenon to the excessive reaction of "irrational" investors at recent news.

The second approach is founded mainly on factors bound to changes of the stock risk level or other factors conform to the efficient market hypothesis. This approach argue that, if the loser portfolios assemble the most risky securities, it is typical that they generate the most important returns, considering the positive correlation between risk and return of such security.

Testing if the market risk (measured by " β ") can be the main source of the abnormal returns generated by the contrarian strategies, DeBondt and Thaler (1985) discovered results that are likely to bias the research design against the overreaction hypothesis. Explicitly, they found that the average betas of the securities in the winner are significantly larger than the betas of the loser portfolios over the test periods. This means that the risk associated to the loser portfolios is least than risk of the winner portfolios. Considering the existing link between return risk, losers portfolios are, therefore, supposed to generate least return than winners. Observing an inverse effect on markets, DeBondt and Thalers (1985) reject the factor "risks" as explanation of the price overreaction hypothesis. They even consider that differences of risk observed between portfolios underestimate the real effect of individuals' excessive reactions. They also add that, so that an extreme past loser portfolio has a weak risk generates a return, in absolute value, more important than past winner portfolio (more riskier), it is necessary that investors have advantage invest in the loser securities.

Using a time-varying three-factor pricing model, Assoé and Sy (2004) examines the profitability of the short-term contrarian strategy in Canadian stock markets from January 1964 to December 1998. They found that this strategy generates statistically significant excess unrestricted returns. However, they show that this result is mainly driven by small firms, especially in January. Moreover, the short-term contrarian investing is not economically profitable when they account for transaction costs.

Antoniou and Galariotis (2005) investigate also the existence of contrarian profits and their sources for the Athens Stock Exchange. Their empirical analysis decomposes contrarian profits to sources due to common factor reactions, overreaction to firm-specific information, and profits not related to the previous two terms. Furthermore, in view of recent evidence that common stock returns are related to firm characteristics such as size and book-to-market equity, they decomposes contrarian profits to sources due to factors derived from the Fama and French (1993; 1996) three-factor model. The results of their study indicate that serial correlation is present in equity returns and that it leads to significant short-run contrarian profits that persist even after they adjust for market frictions.

While studying the sources of an overreaction effect on the Japanese stock market, Chiao and Hueng (2005) show that the firm size (SZ) and the book-to-market ratio (BM) cannot fully explain stock returns on prior-return-based portfolios in Japan. They found that, after controlling for SZ and BM effects, the overreaction effect persists significant and plays an important role in explaining the zero-investment returns constructed by a contrarian strategy.

CONCLUSION

The results of this study violate the weak version of the EMH, that predicts that the stock past recording of price has no predictive power future prices (Fama, 1970). The tests that we have realized on the Tunisian stock market confirms the possibility of the return predictability only from ex-post series and the possibility to generate abnormal returns, without using any accounting news.

However, the limit that we can address to our study is the non investigation of the sources that derives the overreaction phenomenon, and hence, the apparent important profitability generated by the contrarian portfolios. It is, hence, important to signal that these apparent significant returns produced by contrarian portfolios may represent simply the compensation of additional risk factor, such as, the market-risk, the bid-ask-spreads, transaction costs, firm-size effect, seasonal-effect, etc. ... this problematic leads us to further examine the possible sources of overreaction phenomenon discovered by the current study on the Tunisian stock market.

APPENDIX

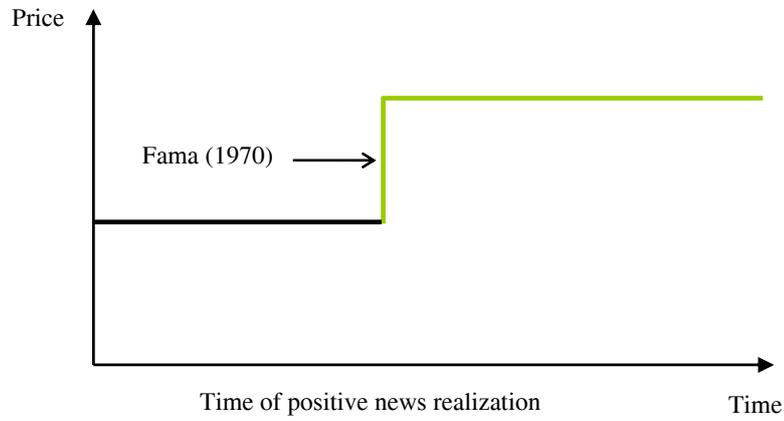


Figure 10. Instantaneous and accurate adjustment of information

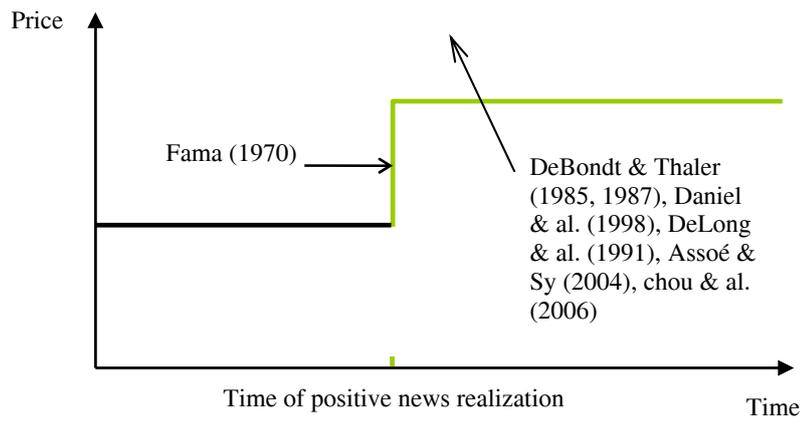


Figure 11. Instantaneous but excessive adjustment of information

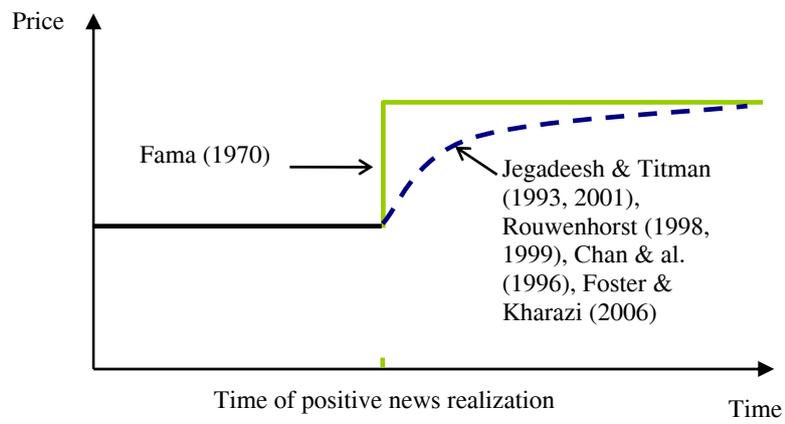


Figure 12. Gradual adjustment of information

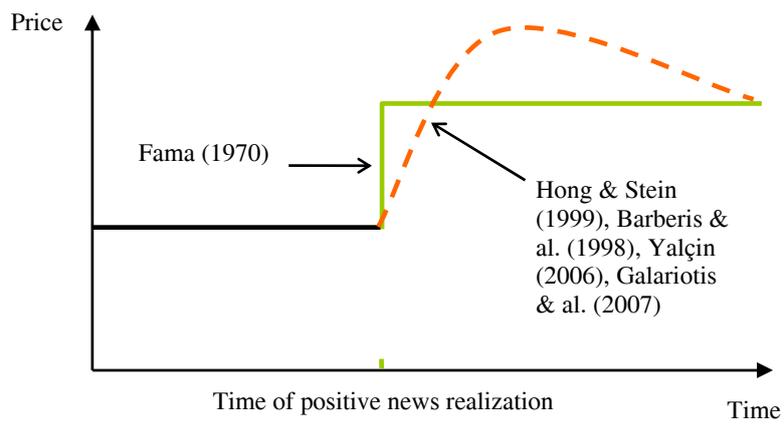


Figure 13. Short-term gradual and long-term excessive adjustment of information

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