

## Understanding Investor Biased Reaction and Financial Decision Making

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**ABSTRACT :** *The objective of this research is to study empirically the under- and overreactions phenomenon of Tunisian market during the period extended from 2010 to 2017, by adopting the methodology of De Bondt and Thaler (1985). We concluded in our study that during a short-term interval that is limited to 6, 9 and 12 months, the underreaction hypothesis was significant in most studied cases. Therefore, it is profitable for investors to realize a momentum strategy by buying stocks that have performed well in the past and selling stocks that have performed poorly during the same test period. In addition, by extending the test period, the overreaction hypothesis was not verified during the long-term test period, i.e. 24 and 32 months. Our results are broadly in favor of under reaction hypothesis of Tunisian securities.*

**KEYWORDS:** Momentum strategy, underreaction, overreaction, securities

**JEL classification:** C23, G11, G14, G21, G41

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### I. INTRODUCTION

The behavioral finance proposes two opposite phenomena that are related to investor behavior. The first phenomenon is the under-reaction of investors to information (Jegadeesh and Titman, 1993). It shows that stocks do not immediately incorporate the right or wrong information. The second phenomenon is the over-reaction of investors to information (De Bondt and Thaler, 1985-1987). This over-reaction implies a turnaround in long-term returns on stock following the announcement of firm event such as annual results, Nizar Raissi & Sahbi Missaoui, (2015). Given the persistence of these two anomalies on the financial markets, several researchers have attempted to provide explanations of these two phenomena where each of them offers an interpretation of how investors react to information, Nikita Andrievskiy & Elizaveta Khudko, (2015); Yulia Yelnikova, (2016). The under-reaction can be explained by different measures. Indeed, Zarouin (1990) concluded that the difference in performance between losing portfolios is probably due to size effect. The ratio Book-to-market (Fama and French (1992; 1993)), others like (Jegadeesh (1991), Lakonishok and Smidt (1986)) prove the importance of January effect at the birth of this phenomenon. The effect of certain performance ratios (Lakonishok, Shleifer, and Vishny (1994), Chan (1988)) rather suggests the risk factor as an explanation of under and over-reaction. This approach seems insufficient to give a complete explanation of these two recently phenomena. Moreover, it appears other analyses and recommendations not related to risk are proposed by supporters of behavioral finance. Barberis, Shleifer and Vishny (1998) explain that the under and over-reaction are due to the bias of representativeness and conservatism. Daniel and others (1998) rely on bias of excessive trust and self-attribution, as well as other behavioral models (Hong and Stein, (1999), De Long, Shleifer, Summers and Walkman (1990), Grinblatt and Han (2001)) who tried to explain the origin of its abnormal yields.

### II. LITERATURE REVIEW

The market efficiency and predictability of market returns are two important research topics in the financial literature. Market anomalies have been highlighted in several empirical studies. One of the most curious phenomena concerns the phenomenon of under and over-reactions, Roman Snishchenko, (2016). However, studies on these two phenomena show that autocorrelations for stock returns on the financial markets are positive in short-term and negative in long-term. As a result, generally strong or weak performance continues in the short term and yields reach average to the long-term, Zi-Yi Guo & Yangxiaoteng Luo (2017). In other words, stocks that perform better than other continue to outperform in the short term before a long-term

reversal takes place. De Bondt and Thaler (1985) have shown that the correction of the past overreaction is more sensitive for the losers and that it is realized mainly during the month of January. Negative auto-correlation of stock returns in longterm which also found by Fama and French (1993). These researchers agreed that negative correlation of long-term returns (from three to five years) during the period 1926-1985 explains 40 % of returns variance in case of small-cap firms and 25% of variance in case of large-cap firms. For his part, Richards (1977) showed that during the period 1969-1995, international indices that outperformed during long periods (between two and five years) become underperforming during succeeding period and vice versa.

Lee and Swaminathan (2000) obtained in the period 1965-1995 that the best-performing stock during six months continues to outperform for one to three years and then underperform. In other hand, the long-term performance explained that momentum is one of the features of investors' under-reaction ends up in over-reaction. For the momentum, it means that the relative continuity of which stock returns correspond to stock trend having registered a good performance (bad) in the past to recorded a better (bad) performance in the future, Riccardo Viale and al., (2018). Jegadeesh and Titman (1993) found a momentum effect for US stock during 1965-1989 (between three to twelve months) as a study period. Indeed, they have reported on average 9.85 points of additional return for the same period compared to portfolios of losing stock. The positive auto-correlation observation is explained by the phenomenon of under-reaction stock value. Culter, Poterba, and Summers (1991) noted the existence of positive and statistically significant monthly auto-correlation in short-term (one to twelve months) of bond market, and foreign currencies in the period 1960-1988. Therefore, a positive auto-correlation of stock in different markets including the French market. The performances generated by annoying strategies (over-reaction) and momentum strategies (underexposure) have obviously aroused the curiosity of researchers. In fact, two contradictory approaches to justify these two phenomena are developed; behavioral and non-behavioral. The objective of our study is to identify, during this section, the nature of phenomenon characterizing the behavior of stock prices on the Tunisian market. To test these phenomena; we are required to test the following hypotheses:

### H1: Under-reaction hypothesis

The stock that outperforms other stock continues to beat in the short term between six and twelve months, hence showing a momentum effect. However, Jegadeesh and Titman (1993) and (2001) proved that the stock prices do not immediately incorporate the new announced information. Though, the winning stocks during a fiscal year continue to be a winner over the succeeding fiscal year, as well as losing stocks in the past continue to perform poorly, hence the positive autocorrelation between returns.

### H2: Overreaction hypothesis

This hypothesis states that the best-performing stock during a period become the worst performers during the succeeding long-term period, from which they show a phenomenon of return to the mean and validate the hypothesis of over-reaction. The phenomenon of reversal relative performance in long period was shown by the pioneering work of De Bondt and Thaler (1985) who compared the stock returns from one period to another between 1926-1982 and obtained that 10% of the best performing stock in period of three to five years underperform the succeeding period, and 10% of the worst performing stocks.

## III. METHODOLOGY

The test of under- and over-reaction hypotheses in our study is similar to that adopted by De Bondt and Thaler (1985) for the formation of winning and losing portfolios. Moreover, we conduct the same econometric tests to study these two phenomena. Indeed, we examine to what degree the behavior of abnormal returns, systematically different from zero in the period subsequent the portfolio formation ( $t = 0$ ), is associated with the abnormal returns to systematic one from the period preceding the formation ( $t < 0$ ).

### 3.1 Data Presentation

Our study is dedicated to Tunisian stock market and more specifically 20 stocks listed on the Tunisian Stock Exchange (BVMT). Our sample includes 20 stocks: AB; ALKIMIA; ATB; ATL; ATTIJARI BANK; BH; BIAT; BNA; BTE; CIL; MONOPRIX; SFBT; SOTUVER; SPDIT; SICAF; STAR; UIB; STB; TUNISAIR; STAR. As for the study period, it starts in January 2010 and finishes in December 2017 (84 months). In our work, the databases used are collected from the website of the (BVMT: [www.bvmt.com](http://www.bvmt.com)). For each stock ( $i$ ), the rate of return of each stock at the period  $t$ ,  $R_{i,t}$  is calculated according to the following formula:

$$R_{i,t} = \frac{C_{i,t} - C_{i,t-1}}{C_{i,t-1}} \quad (1)$$

With:

- The monthly price of the stock  $i$  at month  $t$ ;

- The monthly price of stock *i* in month *t-1*.

The empirical test methodology follows steps to construct the winning portfolios (G) and the losing portfolios (P); secondly, it is essential to measure the degree of statistical significance of observed results.

### 3.2 The Formation of Winning and Losing Portfolios

The market index is calculated as the weighted average of stock returns.

$$R_{m,t} = \sum_{n=1}^N R_{i,t} \quad (2)$$

With, (N) the number of stocks.

The abnormal profitability of each stock (*i*) or in excess (Abnormal Return) (AR) is calculated as the difference between the profitability of stock and market returns.

$$AR_{i,t} = R_{i,t} - R_{m,t} \quad (3)$$

In order to build Winners (winning portfolios) and Losers (losing portfolios), we need the cumulative abnormal returns (CAR<sub>*i,t*</sub>), which is determined by summing the (AR) of stock during a pre-defined formation period (K). This procedure will be repeated *n* times depending on the test period.

$$CAR_{i,t} = \sum_{-k}^0 AR_{i,t} \quad (4)$$

A final step is to create the "w" winning portfolios and the "L" losing portfolios, in ascending order of their returns. The ten most extreme stocks form the "W" portfolio, while the remaining ten stocks establish the "L" portfolio. After, we need to calculate for each portfolio "W" and "L" its average cumulative abnormal returns (ACAR<sub>w,t</sub> and ACAR<sub>L,t</sub>) throughout the test period.

With:

$$ACAR_{w,t} = \frac{1}{N} \sum_{n=1}^N CAR_{w,n,t} \quad (5)$$

$$ACAR_{L,t} = \frac{1}{N} \sum_{n=1}^N CAR_{L,n,t} \quad (6)$$

With (N) in this case is the number of test period.

### 3.3 Statistical Tests of Significance Results

The under-reaction hypothesis expresses that for the period subsequent the formation date (named the test period) (*t* = 0); ACAR<sub>L,t</sub> must be negative, whereas ACAR<sub>w,t</sub> must be positive, so that the average cumulative difference in returns (profitability) between losing portfolios and winners in (*t*) months after the formation period is negative, so that (ACAR<sub>L,t</sub> - ACAR<sub>w,t</sub>) < 0.

The over-reaction hypothesis states that for the period subsequent the formation date (*t* = 0), the ACAR<sub>L,t</sub> must be positive while the ACAR<sub>w,t</sub> is negative for the difference in average of cumulative returns. Losing and winning portfolios in (*t*) months after formation period is positive, so that:

$$(ACAR_{L,t} - ACAR_{w,t}) > 0 \quad (7)$$

Then, we test the significance of difference in average cumulative abnormal returns between winning and losing portfolios (ACAR<sub>A,t</sub>) at time (*t*) by calculating t-statistic.

With:

$$ACAR_{A,t} = ACAR_{L,t} - ACAR_{w,t} \quad (8)$$

Therefore, we first calculate the variance of CAR<sub>*i*</sub>:

With:

$$S_t^2 = \frac{\sum_{n=1}^N (CAR_{w,n,t} - ACAR_{w,t})^2 + \sum_{n=1}^N (CAR_{L,n,t} - ACAR_{L,t})^2}{2(N - 1)} \quad (9)$$

The t-statistic expression of arbitrage portfolio is as follows:

$$T_t = \frac{(ACAR_{L,t} - ACAR_{w,t})}{\sqrt{2S_t^2/N}} \quad (10)$$

In order to refine the study of stock abnormal reaction on Tunisian market, we selected different training periods of 6, 9, 12, 24, and 32 months.

#### IV. FINDINGS

The return of arbitrage portfolio (zero investment portfolios) is defined as the return of losing portfolio minus the return of winning portfolio.

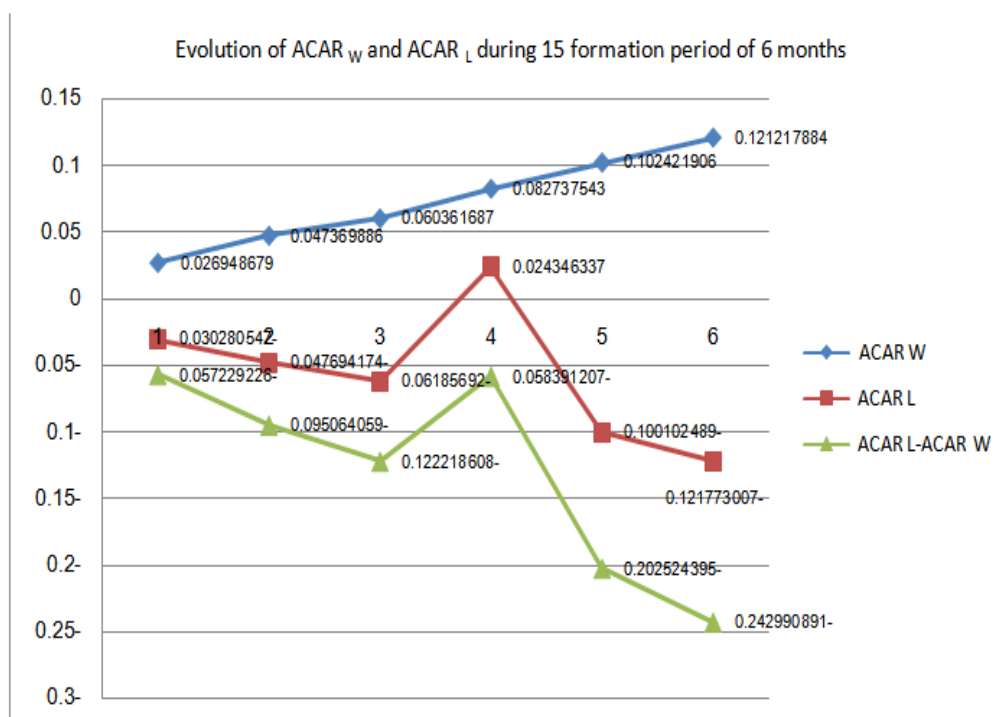
$$ACAR_{A,t} = ACAR_{L,t} - ACAR_{W,t} \quad (11)$$

If the arbitrage portfolio generates abnormally negative returns during the test period, we conclude that stock prices follow a pattern of continuity (momentum). The most profitable strategy is therefore to buy the winning stocks in the past and sell those former losers. If the arbitrage portfolio generates abnormally positive returns during the test period, we conclude that stock prices are returning to the mean. Therefore, to benefit from abnormal profits, it is interesting to apply opposite strategy. If the arbitrage portfolio generates abnormally statistically insignificant returns during the test period, we conclude that the prices follow a random market phenomenon. To test results, we have already developed as presented below on formation periods ranging from 6, 9, 12, 24 and 32 months. During the study period between 2010 and 2017, there are 15 formations periods of 6 months. The number of stocks held for each period is constant (20 stocks). The following table presents the evolution values of average cumulative abnormal returns in the short term (formation period of 6 months).

**Table 1.** Evolution of average cumulative abnormal returns during a 6-months formation period

Date	ACAR <sub>w</sub>	ACAR <sub>L</sub>	ACAR <sub>L</sub> -ACAR <sub>w</sub>
-6	0.0269	-0.0302	-0.0572
-5	0.0473	-0.0476	-0.0950
-4	0.0603	-0.0618	-0.1222
-3	0.0827	0.0243	-0.0583
-2	-0.1024	-0.1001	-0.2025
-1	0.1212	-0.1217	-0.2429

The results of table are shown in figure below:



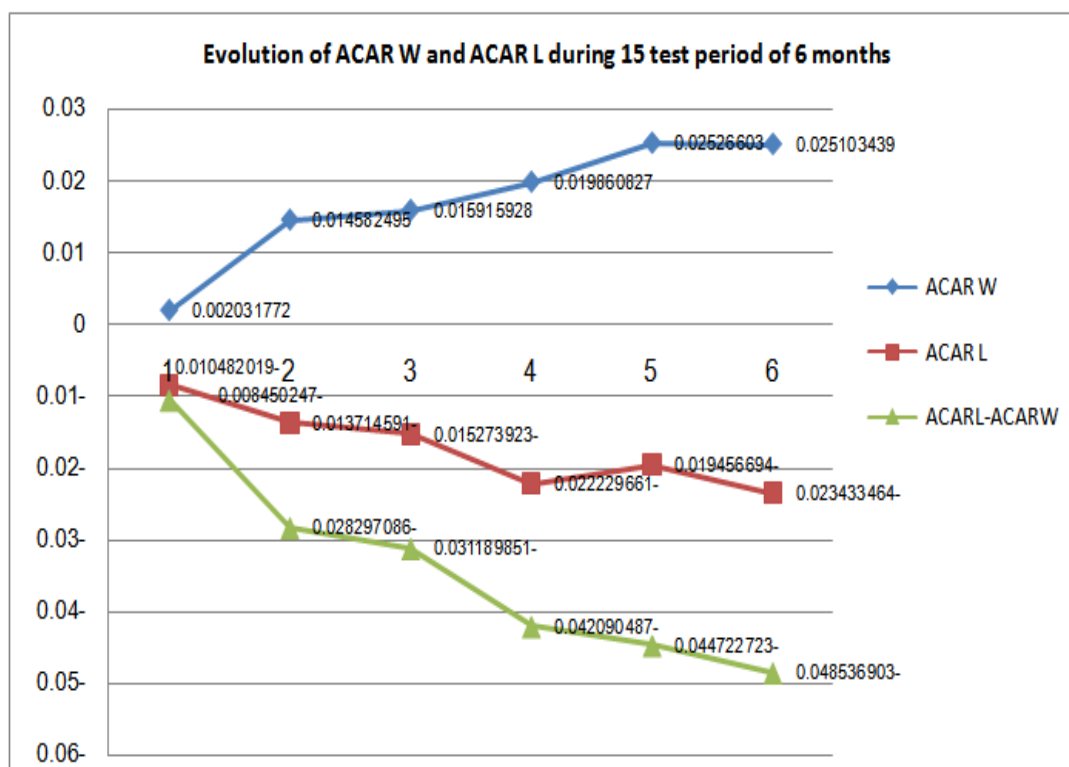
**Figure 1.** Curve of average cumulative abnormal returns during 15 formation period of 6 months

During the formation period, it is clear that the winning portfolio has abnormal returns higher than those generated by the losing portfolio. Indeed, the cumulative abnormal returns of the arbitrage portfolio (ACAR<sub>L</sub> - ACAR<sub>w</sub>) are negative throughout the period. Going to examine the excess returns over a 6-months test period, the results are shown in the table below:

**Table 2.** Evolution of average cumulative abnormal returns during a 6-months test period

Date	ACAR <sub>w</sub>	ACAR <sub>L</sub>	ACAR <sub>L</sub> -ACAR <sub>w</sub>	T student
1	0.0020	-0.0084	-0.0104	-1.191
2	0.0145	-0.0137	-0.02829	-2.583
3	0.0159	-0.0152	-0.0311	-2.076
4	0.0198	-0.0222	-0.4209	-2.097
5	0.0252	-0.0194	-0.0447	-2.091
6	0.0251	-0.0234	-0.0485	-2.066

By examining the reaction of two portfolios after the formation period, that is to say during the test period, the results show that the portfolios returns follow a momentum behavior, that is to say continuity. Indeed, the former loser portfolio retains its position for the next 6 months as its average cumulative profitability remains negative (ACAR<sub>L</sub>), as for the former portfolio, it also continues to achieve positive average cumulative returns. However, the arbitrage portfolio continues to generate negative returns during the test period. In addition, we find that the return on the arbitrage portfolio is statistically significant (T-statistics = - 0.0485 at the end of the formation period, i.e. for the 6<sup>th</sup> month of testing). As a result, former losers and former winners experience continuity of returns during the 6-months test period. Therefore, it is interesting to adopt a momentum strategy during the 6-months test period of buying past winning portfolios and selling past losing portfolios for the arbitrage portfolio to generate positive returns. The results presented above are presented in the following figure:



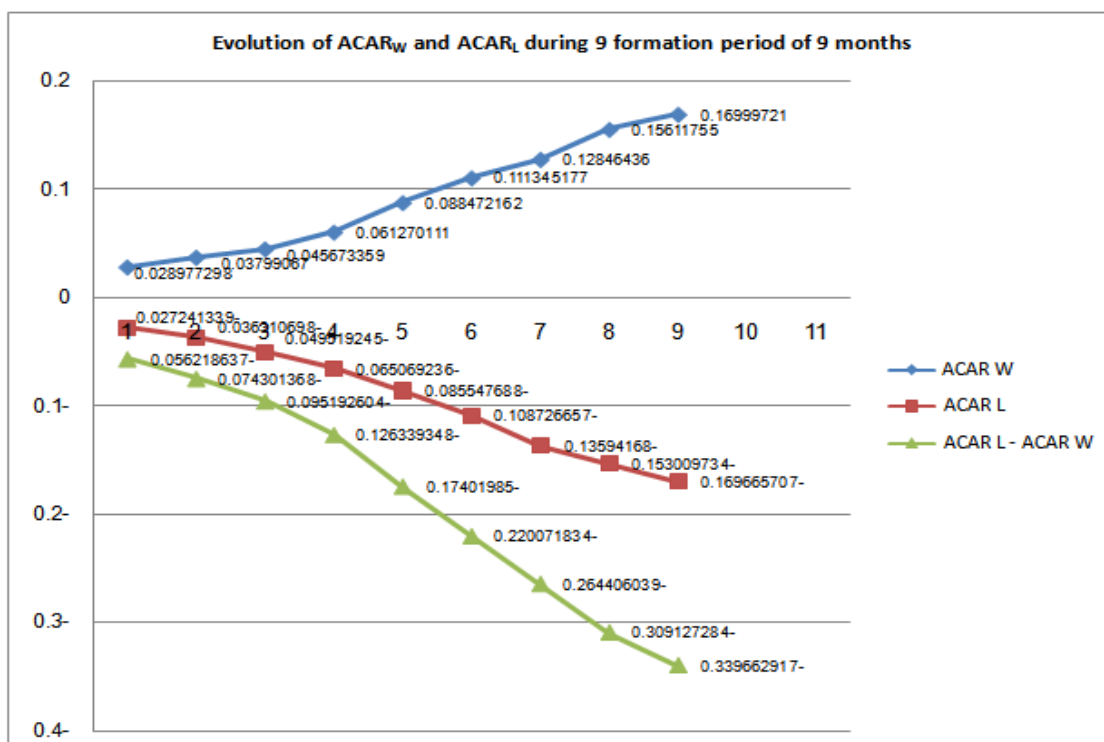
**Figure 2.** Curve of average cumulative abnormal returns of 15 test period of 6 months

In conclusion, the results for a 6-month test formation period verify the hypothesis of continuity (momentum) in the Tunisian market at short term. Following the same procedure as before, we calculate the ACAR<sub>w</sub> and ACAR<sub>L</sub>. However, for a 9-months formation period, we have 9 formation sub-periods. The results appear in the table below:

**Table 3.** Evolution of average cumulative abnormal returns during a 9-month formation period

Date	ACAR <sub>w</sub>	ACAR <sub>L</sub>	ACAR <sub>L</sub> -ACAR <sub>w</sub>	T -student
-9	0.0289	-0.0272	-0.0561	-3.236
-8	0.0379	-0.0363	-0.0743	-11.44
-7	0.0456	-0.0495	-0.0951	-15.234
-6	0.0612	-0.0650	-0.1263	-3.124
-5	0.0884	-0.0855	-0.1740	-3.569
-4	0.1113	-0.1087	-0.2200	-11.178
-3	0.1284	-0.1359	-0.2644	-3.147
-2	0.1561	-0.1530	-0.3091	-3.124
-1	0.1699	-0.1696	-0.3396	-3.269

The results presented above are presented in the following figure:



**Figure 3.** Curve of average cumulative abnormal returns during 9 formation period (9 months)

During a 9-months formation period, the curve of average cumulative abnormal returns in the winning portfolio is increasing while losing portfolio is decreasing (Figure 3). As a result, the difference in ACAR is always negative for t ranging from -9 to -1. For more detail, to examine the evolution of excess returns during a 9-months test period, the results are shown in the table below:

**Table 4.** Evolution of average cumulative abnormal returns during a 9-months test period

Date	ACAR <sub>w</sub>	ACAR <sub>L</sub>	ACAR <sub>L</sub> -ACAR <sub>w</sub>	T student
1	-0.0024	0.0009	0.0034	-2.125
2	0.0013	-0.0037	-0.0051	-2.156
3	-0.0001	-0.0058	-0.0056	-1.498
4	0.0036	-0.0108	-0.0145	-2.159
5	0.0130	-0.0126	-0.0257	-2.659
6	0.0018	-0.0027	-0.0045	-1.369

7	-0.0002	-0.0081	-0.0790	-1.856
8	-0.0001	0.0007	-0.0008	-2.236
9	0.0063	-0.0043	-0.0107	-2.568

Based on the results shown in the table above, we find that the average cumulative profitability of the ACAR<sub>w</sub> winning portfolios is positive except for a few months of test period while ACAR<sub>L</sub> continues to be negative and necessarily ACAR<sub>L</sub>-ACAR<sub>w</sub> be a negative difference for most test months except for the 1<sup>st</sup> month and the 8<sup>th</sup> month of test period which confirms the presence of under-reaction phenomenon on the Tunisian market; with a significance for the majority of test months with ( t-statistic = -2.156) for the 1<sup>st</sup> month whereas for the 9<sup>th</sup> month (t-static = -2.568). As a conclusion of test, there is a phenomenon of short-term under-reaction in the Tunisian market that characterizes the formation of stock prices.

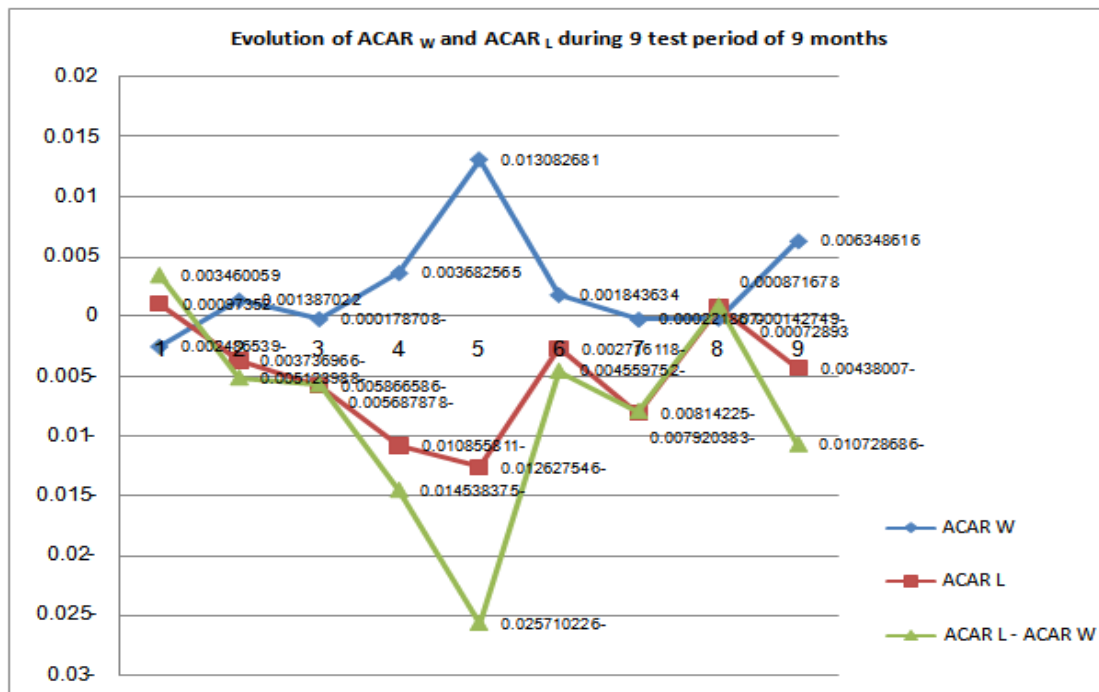


Figure 4. Curve of average cumulative abnormal returns of 9-months test period

Between 1/1/2010 and 31/12/2017 there are 7 formation sub-periods of 12 months. The number of stocks in the sample is constant (20 stocks) across all formation period and test period. We present the results in the following table:

Table 5. Evolution of average cumulative abnormal returns during a 12-months formation period

Date	ACAR <sub>w</sub>	ACAR <sub>L</sub>	ACAR <sub>L</sub> -ACAR <sub>w</sub>
-12	0.0279	0.0369	0.0089
-11	0.0366	0.0058	-0.0308
-10	0.0480	-0.0027	-0.0508
-9	0.0543	-0.0027	-0.1014
-8	0.0733	-0.0470	0.1108
-7	0.0951	-0.0374	0.1982
-6	0.0951	-0.1031	-0.1982
-5	0.1309	-0.1442	-0.2751
-4	0.0543	-0.0470	-0.1014
-3	0.0480	-0.0027	-0.0508
-2	0.1433	-0.2481	-0.3915
-1	0.1324	-0.2461	-0.3787



The results presented above are presented in the following figure:

(12 months)

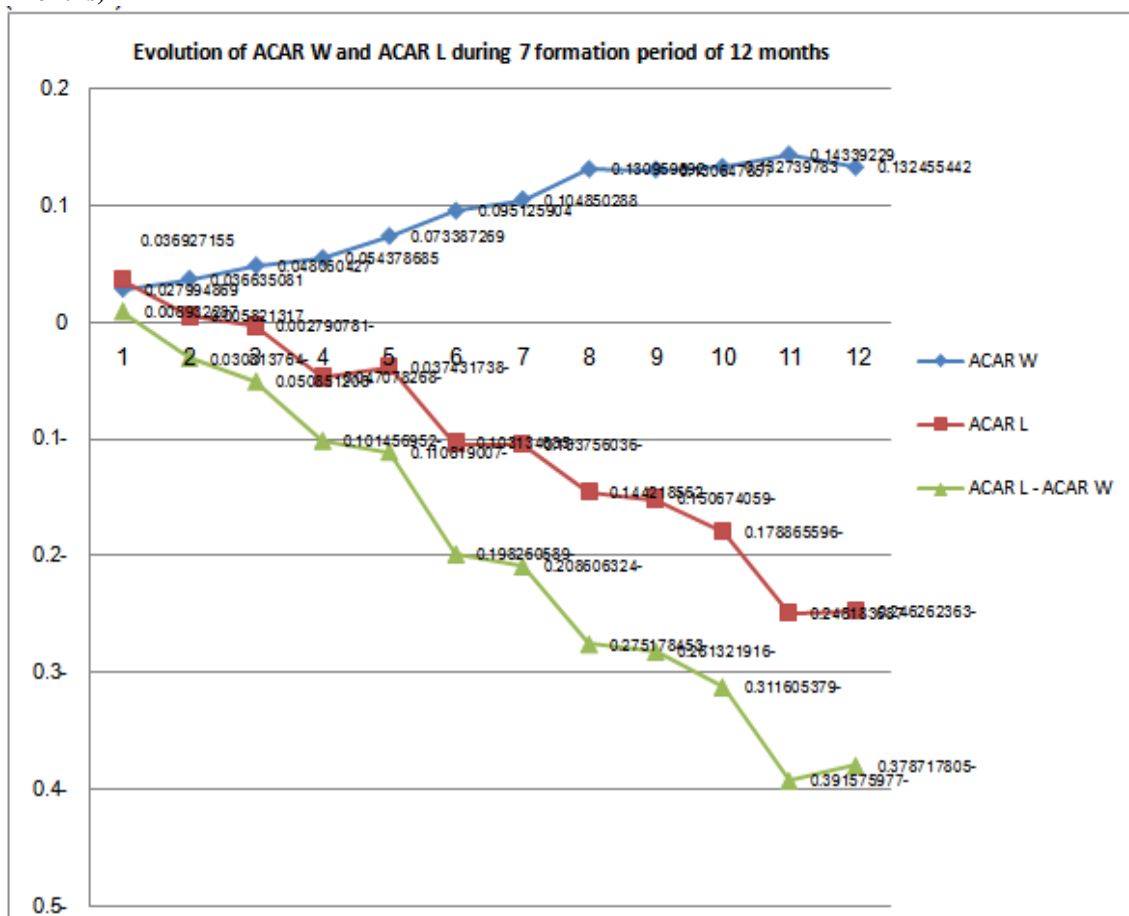


Figure 5. Curve of average cumulative abnormal returns of 7 formation periods

In what follows, we will present their values during the test period and the compliance of the over-reaction during a 12-months' time interval.

Table 6. Evolution of average cumulative abnormal returns on a 12 months test period

Date	ACAR <sub>w</sub>	ACAR <sub>L</sub>	ACAR <sub>L</sub> -ACAR <sub>w</sub>	T student
1	0.0066	-0.0101	-0.0168	-0.2642
2	0.1870	-0.0163	-0.0351	-0.3447
5	0.0334	-0.1510	-0.0485	-0.2384
7	0.0171	-0.0070	-0.0242	-0.1245
8	0.0161	-0.0072	-0.0234	-0.1034
9	-0.0026	0.0097	0.0124	0.0665
10	-0.0054	0.0060	0.0114	0.0540
11	-0.0018	0.0016	0.0034	0.0151
12	0.0059	-0.0043	-0.0102	-0.0476

We notice that during the 12<sup>th</sup> month, i.e. the last month of the test period, the losing portfolio after a reversal of its position during the 9<sup>th</sup> month, 10<sup>th</sup> month and 11<sup>th</sup> month returns to its initial position for become a loser. The same situation was recorded for the winning case which returns to a winning position after it is negative during the 9<sup>th</sup> month, 10<sup>th</sup> month and 11<sup>th</sup> month. In the same way, the arbitrage portfolio records in a first step (from the 1<sup>st</sup> month to the 10<sup>th</sup> month) negative excess returns. However, during the 11<sup>th</sup> month and 12<sup>th</sup> month, it reverses its position to keep its initial negative position during the 12<sup>th</sup> month. The over-reaction theory states that any extreme movement up or down must necessarily be followed by another movement in the opposite direction and more than this movement is more extreme than its adjustment will be later. However, the results above assert this conclusion to the extent that the movements subsequent to formation date prove this conclusion simultaneously for the winning portfolios as for those losers for the 10<sup>th</sup>, 11<sup>th</sup> and 12<sup>th</sup> that is only for the last test of 3 months for 12 months period. Whereas, we notice the domination of under-reaction



phenomenon which is very clear from the first month of test until the 9 month of the period. As a conclusion we can say that for a test period of 12 months the phenomenon of under-reaction seems clear from the 1<sup>st</sup> month to the 9<sup>th</sup> or 9 month whereas the over-reaction was clear only for 3 months. The results presented above are validated in the following figure:

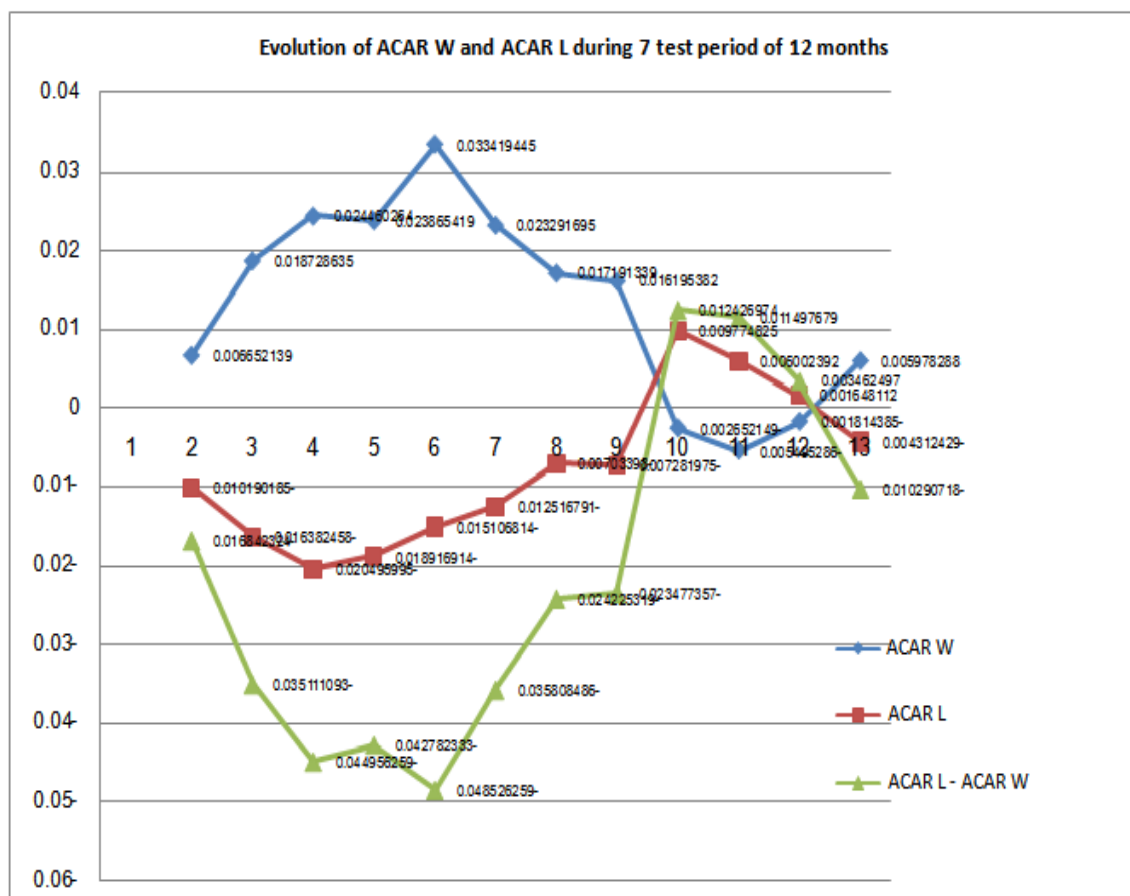


Figure 6. Curve of average cumulative abnormal returns of 7 test period (12 months)

During the study period between 2010 and 2017, there are 3 formation sub-period of 24 months. The following table summarizes all ACAR values and their differences throughout this formation period.

Table 7. Evolution of average cumulative abnormal returns during a 24-months formation period

Date	ACAR w	ACAR L	ACAR L - ACAR w
-24	-0.0351	-0.0635	-0.0283
-19	0.1106	-0.0682	-0.1788
-17	0.1567	-0.1231	-0.2788
-16	0.2019	-0.1899	-0.3919
-10	0.6340	-0.5549	-1.1890
-8	0.7237	-0.6149	-1.3387
-5	0.8294	-0.7438	-1.5732
-2	0.9336	-0.8412	-1.7748
-1	0.8802	-0.8252	-1.7054

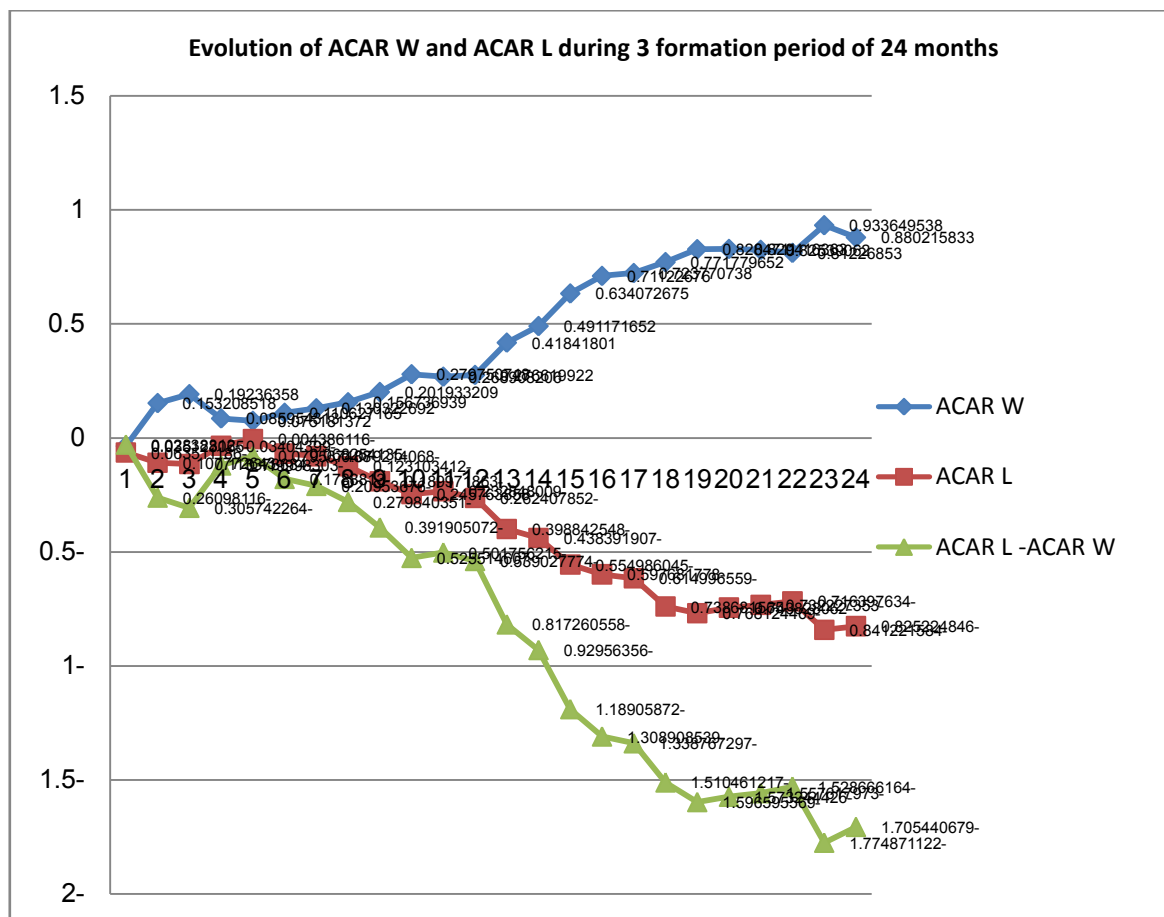


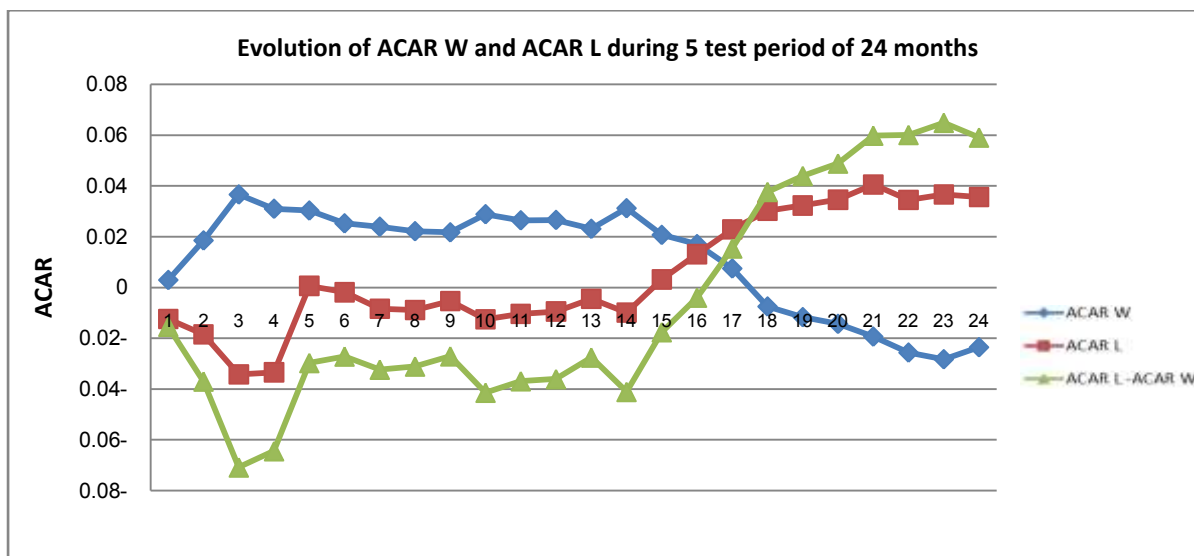
Figure 7. Curve of average cumulative abnormal returns of 3 formation period

(24 months)

Table 8. Evolution of average cumulative abnormal returns during a 24-months test period

Date	ACAR <sub>w</sub>	ACAR <sub>L</sub>	ACAR <sub>L</sub> -ACAR <sub>w</sub>	T- student
1	0.0029	-0.0123	-0.0153	-1.115
2	0.0185	-0.0184	-0.0369	-4.826
7	0.0239	-0.0083	-0.0322	-1.118
15	0.0207	-0.0031	-0.0175	-0.211
16	0.0170	0.0131	-0.0039	-0.049
17	0.0075	0.0229	0.0154	0.176
20	-0.0143	0.0345	0.0489	0.445
23	-0.0282	0.0367	0.0649	0.669
24	-0.0235	0.0356	0.0591	0.573

By examining the evolution of abnormal returns during a 24-months test period (Figure 8), we find that until the 16<sup>th</sup> month, the losing portfolio continues to generate negative returns and there is no reversal of the situation only from the 17<sup>th</sup> month. In addition, the winning portfolio continues to produce positive returns in surplus markets until the 17<sup>th</sup> month. In the first stage (up to the 16<sup>th</sup> month), the arbitrage portfolio records negative market returns and from the 17<sup>th</sup> month onwards, the situation is reversed and the excess returns become positive until the 24<sup>th</sup> month. It seems clear that for a 24months test period the existence of the over-reaction on the Tunisian market is stronger than the appearance of under-reaction.

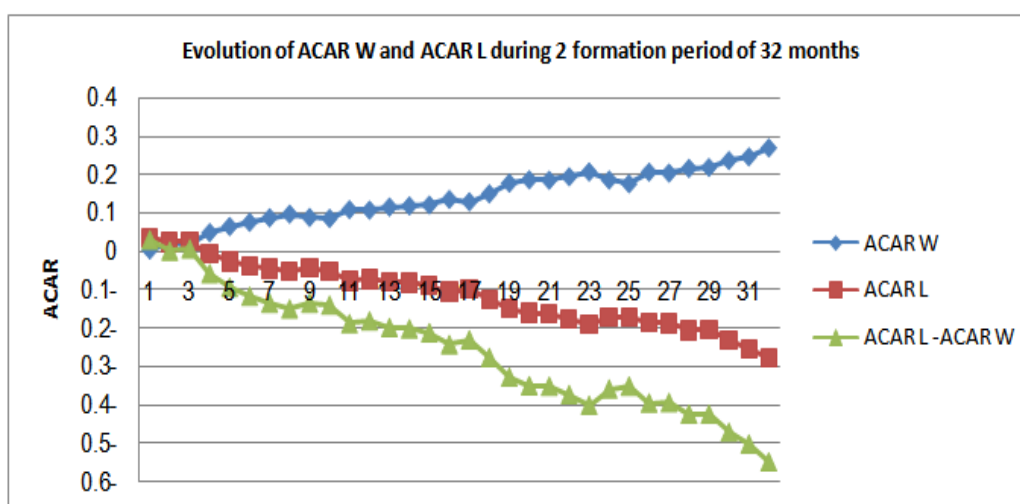


**Figure 8.** Curve of average cumulative abnormal returns during 5 test period of 24 months

During the study period between 2010 and 2017, there are 3 formation sub-periods of 24 months. The number of selected stocks is constant during the formation and test period (20 stocks). As in previous studies, we begin by examining the excess returns of the winning (w) and losing (L) portfolios as well as their differences.

**Table 9.** Evolution of average cumulative abnormal returns during a 32 months formation period

Date	ACAR w	ACAR L	ACAR L-ACAR w
-32	0.0023	0.0342	0.0318
-30	0.0161	0.0247	0.0086
-28	0.0646	-0.0267	-0.0914
-25	0.0972	-0.0506	-0.1479
-20	0.1160	-0.0803	-0.1963
-15	0.1510	-0.1236	-0.2746
-10	0.2085	-0.1902	-0.3987
-2	0.2484	-0.2515	-0.5000
-1	0.2719	-0.2748	-0.5468



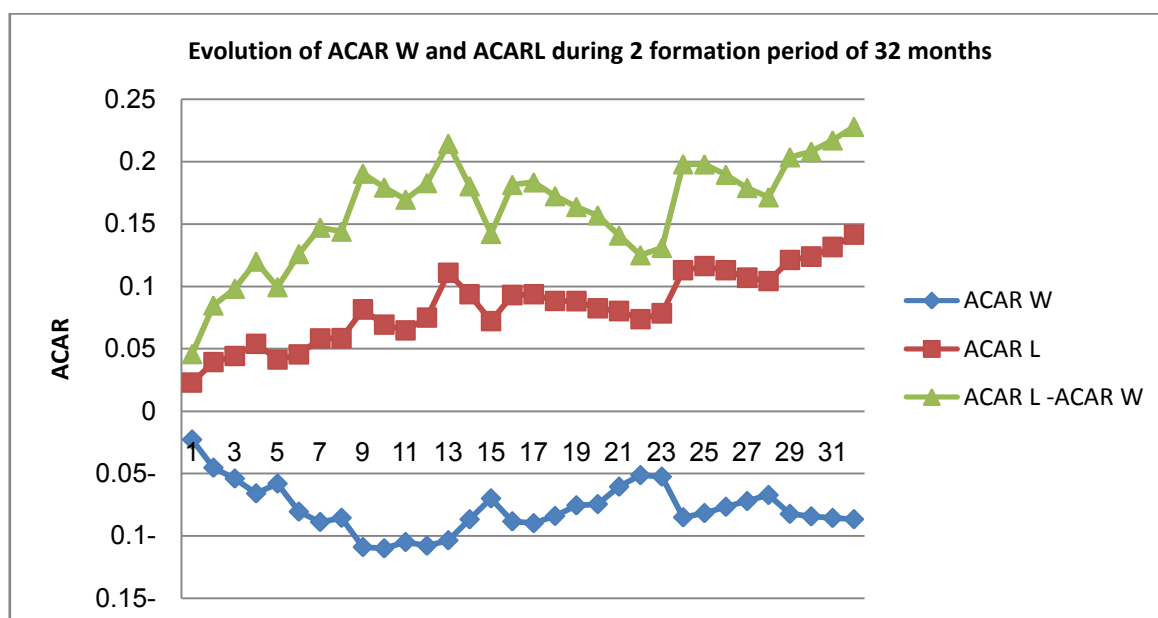
**Figure 9.** Curve of average cumulative abnormal returns of 2 formation period of 32 months

Looking at the figure above, we find that even for a 32-months formation period the excess returns to the (W) and (L) portfolios are respectively up and down. Thus, the difference remains negative throughout the formation period. After studying the phenomenon of over-reaction during formation and holding period of 24 months, we calibrate our study, in the longer term, during a period of 32 months. We obtain the following results:

**Table 10.** Evolution of average cumulative abnormal returns during a 32-monthsformation period

Date	ACAR <sub>w</sub>	ACAR <sub>L</sub>	ACAR <sub>L</sub> -ACAR <sub>w</sub>	T- student
1	-0.0227	0.0229	0.0457	1.042
7	-0.0889	0.0583	0.1472	0.776
15	-0.0699	0.0721	0.1421	0.8622
20	-0.0745	0.0824	0.1570	0.744
25	-0.0813	0.1162	0.1979	0.679
27	-0.0721	0.1069	0.1790	0.651
30	-0.0843	0.1238	0.2082	0.710
31	-0.0856	0.1315	0.0217	0.701
32	-0.0866	0.1413	0.2280	0.654

The over-reaction is based on the positivity of the ACAR<sub>L</sub> difference ACAR<sub>w</sub>. Indeed, the latter is greater than zero throughout the test period except that these results are statistically insignificant. Similarly, these results reveal an asymmetry of excessive reaction between the losing portfolio and the winning portfolio, since the excess returns of the losers are greater than those of the winners. It is important to note that the phenomenon of reversal to the average returns from the first month for the losing portfolio than for the winning portfolio. This is explicitly considered in (figure.10) which visualizes the evolution of ACAR<sub>w</sub> and ACAR<sub>L</sub> during the 36-months test period.



**Figure 10.** Curve of average cumulative abnormal returns of 2 formation period for 32-months

### V. DISCUSSION AND CONCLUSION

The objective pursued in our work is to demonstrate the existence of biased reaction of investors in the Tunisian financial market through the existence of phenomena of over and under-reaction of stocks. Indeed, psychological research shows that investors are not totally rational; it is in this perspective that our research work. The research was directed at studying, on the one hand, the under-reaction on Tunisian market, and on the other hand, the over-reaction on the same market. The first section apprehended the theoretical divergence that exists between the theory of efficiency and the theory of behavior. To clarify this, the literature review defined generally the main bases of classical theory. This theory is based on an extremely simplified design for investor behavior that has always assumed that investors are perfectly rational. A market is said to be efficient if the prices instantly reflect all available information. In other words, the information that arrives on the market is immediately used for this fact; and it is instantly incorporated into the prices. This implies prices that are in line with investors' expectations, so no arbitrage opportunity remains to be exploited and investors are rational insofar as they make optimal choices while basing themselves on this information. In a second step, this section states the presence of certain anomalies on the financial market. Indeed, a rapid development is supported works and research that contradict the validity of efficiency hypothesis, especially with the appearance of various anomalies proved by methodologies and tests very powerful such as speculative bubbles, seizures, over-reaction, under-reaction, etc. Thirdly, special attention has been focused on a new paradigm called "behavioral finance" that has emerged to try to overcome the difficulties and limitations of the traditional paradigm. Advanced research in the field of modern finance offers an alternative example where investor psychology gives

rise to cognitive errors in the analysis and processing of information. Behavioral theory assumes that investors can make choices not rationally but through their judgments because they are unable to process information properly. It is in this context that the first section is located, whose main objective is to define the theory of financial market efficiency in favor of behavioral finance. In second section, we have firstly attempted to clarify the idea that the decision process globally and the price formation process of different financial assets especially are influenced by the psychology, emotions and behaviors of investors. However, investor sentiment affects how they form their beliefs that are affected by their degree of pessimism and optimism. Secondly, we demonstrate the persistence of two anomalies that are under and over-reaction. These two anomalies are the subject of several researches and different explanations. Their existence on the market violates the efficiency hypothesis of markets. In fact, under-reaction is a short-term phenomenon that is based on the positive dependence of profitability. According to the literature, the optimal duration of this phenomenon is between 6 and 12 months. While over-reaction is a long-term persistent phenomenon, its optimal duration is during a period of time that exceeds 12 months. In this study, we have shown that from the last two phenomena mentioned above, it is possible to profit from an inefficient market. However, the short-term under-reaction gives rise to a particular style of strategy called "momentum strategy", whereas, the over-reaction allows to practice a "contrarian strategy". Moreover, we tried to justify empirically the existence of the phenomenon of under and over-reaction on Tunisian market. As a first step, a literature review began where the majority of the work on these two phenomena proves the existence of these two effects on different markets in the world, while studying the possible reasons argued in the literature causing the performance abnormal opposite strategies and momentum. The explanations are based on two type's non-behavioral and behavioral approaches. Indeed, the results of the studies indicate that investors do not react correctly to the information; they receive which contradicts the theory of efficient markets. Among the authors who proved the effects of over and under-reaction, there are those who have explained the occurrence of these phenomena by non-behavioral factors such as De Bondt and Thaler (1985), Jegadeesh and Titman (1993), Fama and French (1993) such as size, liquidity, market premium, accounting ratios, January effect, etc. However, behavioral explanations describe irrational behaviors related to psychological bias in the processing, understanding and weighting of new information. Among the behavioral biases that explain the phenomena of under and over-reaction: over-confidence, self-attribution, the bias of conservatism and representativeness, limited attention and the effect of disposition, etc. In a second part of this research, we used empirical testing of the two phenomena on the Tunisian stock market (BVMT) by adopting the methodology of De Bondt and Thaler (1985). However, our empirical study is based on 20 companies listed on the (BVMT) for the period from 1/1/2010 to 31/12/2017 for a total of 84 months. The main conclusions that we have reached reveal that the five tests performed (6 months, 9 months, 12 months, 24 months and 32 months), leads us to several deductions. Indeed, we prove that the difference of the ACARs for all the short-term periods (6, 9 and 12 months) is generally in similarity with the under-reaction hypothesis. This result shows that winning stocks (losers) continue to be winners (losers) during a short formation period. Similarly, the study shows that the difference in ACARs by hearing the formation period at (24 and 32 months) shows that the results do not agree with the over-reaction hypothesis. On the one hand, the results of the long-term study shows that winning stocks (losers) will become losers (winners) for a longer training period for the minimum number of test months while for the majority of months the under-reaction effect records a presence strong on the market more these results remain insignificant. In the light of the results obtained by this study, we can report the existence of the phenomenon of under and over-reaction on the Tunisian market during the period of study between 2010 and 2017. However, such an effect of under-reaction, encourages investors to take advantage of this phenomena while one adopting a momentum strategy which consists of buying stocks that have performed a good performance in the past and sell stocks that have had a bad performance during the same period test at short-term. On the other hand, our research presents a certain number of limits which can be the subject of several tracks of the future researches. Thus, the results obtained are probably influenced by the choice of dates of formation and test, the method of calculating returns and residues. Similarly, it is difficult to identify the exact date on which investors' under-react and over-react to the information. We can thus extend the size of our sample according to the availability of data as well as the duration of study. In addition we can test upset strategies and momentum strategies by controlling factors such as the January effect, size, liquidity and the difference between the systematic risk of winning and losing portfolios. Thus, in order to achieve a better understanding of the results obtained we can set limits. Firstly, it is noted that methodology implementation of our study to detect the existence of phenomena of under and over-reaction suffers from certain limitations raised by previous studies. The results obtained are undoubtedly influenced by the choice of formation and test dates. It is difficult to identify the exact date on which investors under-react and over-react to information even a period from 2010 until 2017; it is a very short period to study these two phenomena since the effect of on -reaction requires a very long time for its appearance on the market, and it is a phenomenon of long term and not short term. However, De Bondt and Thaler have examined this long-term phenomenon during a period of 3 to 5 years. Another limitation in this study concerning the size of our sample concerning only 20 companies from all

companies listed on the BVMT between 2010 and 2017. However, this number of samples is considered low compared to previous empirical studies carried out. Still, the date of our study is between 2010 and 2017 is a total of 84 months, a number of months considered low compared to previous studies on both phenomena study such as the study of Emiliios, Galariotis, Phil Holmes and Xiaodongs (2007) on the London market which was from 1964 until 2005.

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