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Representativeness Heuristic, Investor Sentiment and Overreaction to Accounting Earnings: The Case of the Tunisian Stock Market

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Abstract

The representativeness heuristic is a psychological bias which means that, under uncertainty, investors are prone to believe that a history of a remarkable performance of a given firm is "representative" of a general performance that the firm will continue to generate into the future. Investors subjects to this heuristic overreact, thus, to salient and similar information about firms past performance such as similar consecutive earnings surprises. I have examined this relationship on the Tunisian stock market using accounting and stock market data over the period 1990-2010. Weak evidence has been found concerning this relationship. The results show a partial association between past earnings surprises and future abnormal returns explained by negative earnings surprises autocorrelation.

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*Keywords:*Behavioral Finance, Representativeness Heuristic, Investor Sentiment, Overreaction;

1. Introduction

Since the 80s, economists have begun to be more and more interested in psychology to explain the financial market participants' behavior and some financial market anomalies. A new field called *behavioral finance* has therefore emerged as a mixture of psychology and finance to explain these anomalies. This term applies, according to Shiller (2000), to research on stock markets which accounts for all the components of the human behavior, including elements of psychology and sociology. This new approach reproaches the participants in financial markets for being irrational or, at least, to have a bounded rationality.

One of the first forms of irrationality is the stock market overreaction documented by De Bondt and Thaler (1985). The overreaction is defined by these authors as the overweighting of unanticipated and dramatic information. It causes a return reversal and a negative auto-correlation over long horizons (beyond one year) challenging the efficient market hypothesis. Such behavior results from the fact that in decision-making, the majority of the individuals violates the law of Bayes rule and tend, consequently, to overweight the recent information to the detriment of the past information, a behavior which represents an example of a heuristic identified by Tversky and Kahneman (1974) called *representativeness*.

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The term "heuristic" is defined by Grether (1992) as *"a rule of thumb or decision aid by which individuals may judge likelihood"*. The main conclusion of the psychological studies on heuristics shows that they bias the judgments of individuals and cause systematic errors. The representativeness heuristic is one of the most important heuristics documented by psychologists and adopted later by the behavioral finance proponents to explain some stock market anomalies and investor behavior (see, for example, Barberis, Shleifer &Vishny, 1998; Shefrin, 2008). Representativeness means, according to Kahneman and Tversky (1972), that in situations of uncertainty, people *"evaluate the probability of an uncertain event, or sample, by the degree to which it is: (i) similar in essential properties to its parent population; and (ii) reflects the salient features of the process by which it is generated"*.

In the stock markets, an investor subject to the representativeness heuristic interprets the past performance of firms as being representative of a general performance that the firm will continue to generate in the future. He can simply think that a firm having consecutive positive earnings surprise will continue to generate a similar performance although the past observed performance could not be representative of the company. Also, he can think that a firm having consecutive negative earnings surprise is a failed firm and will continue to generate weak performance.

Barberis, Shleifer and Vishny (1998) were the first ones to have modeled this behavior to explain investors under and over-reaction in stock markets. In their investor sentiment model, the investor does not realize that earnings follow a random walk. Rather, he believes that they follow two regimes: a mean reversion (regime) 1 or a trend (regime) 2. An investor subject to the conservatism bias in face of an earnings announcement reacts partially to this announcement; that is, he believes that a shock in the earnings will be followed more probably by a negative shock according to regime 1. On the other hand, after a series of similar shocks, the investor applies the representativeness heuristic and uses the model 2 to anticipate the earnings of the next period by extrapolating the performance into the future. This means that he overreacts to a series of similar information.

Although there are few studies exploring the contribution of the representativeness to explain the investor behavior, their empirical results are mixed. Some psychological and experimental studies show that this concept is not convenient to detect the individual behavior in real economic states (Grether, 1980, 1992; Charness, Karni & Levin, 2010). In contrast, other studies which lie within the behavioral finance approach find that this heuristic affects the investor's decision when evaluating stocks (Barberis, Shleifer & Vishny, 1998; Bloomfield & Hales, 2002; Frieder 2004, 2008; Kaestner, 2006; Alwathainani, 2012).

Furthermore, the impact of the representativeness heuristic remains limited to experimental studies carried out in laboratories under controlled conditions. Moreover, the few studies which examined this heuristic on stock markets with real data are limited to developed markets. To the best of our knowledge, this psychological bias has not been yet examined on emergent markets. I try, along with this study, to contribute to this debate by studying the impact of this heuristic on the Tunisian stock market behavior. In particular, I try to show whether representativeness heuristic causes overreaction to the accounting earnings information according to the behavioral finance theory.

The remainder of the paper is organized as follows: section 2 presents a short psychological and financial literature review on the representativeness heuristic and the relation between this heuristic and investor overreaction. Section 3 explains the research design, section 4 presents the empirical findings and section 5 concludes.

2. Literature review

2.1. Psychological and experimental literature

Kahneman and Tversky (1972) and Tversky and Kahneman (1971, 1974, 1982a, 1982b) underline that the representativeness heuristic is used by individuals in several contexts and present a number of experiments supporting their hypothesis. They show that when people are asked to formulate judgments under uncertainty, most of them make mistakes because instead of constructing their answer from a logical and probabilistic reasoning, they proceed to a reasoning based on the representative information. They show that this heuristic causes judgment errors such as neglecting bias rate in violation of the bias rule, conjunction fallacy and applying law of small numbers.

Bloomfield and hales (2002), Bar Hillel and Wagenaar (1991), and Rapoport and Budescu (1992, 1997) show that people are more prone to expect that even short sequences resulting, for example, from coin flips or from drawings of balls from an urn or sequences representing firm earning changes contain proportions similar to the long sequences from which they are drawn (For a review of these studies and others, see Rabin, 2002).
Grether (1980, 1992), Charness, Karni and Levin (2010) and Gigerenzer (2005) underlined that heuristics and biases deduced from experimental environment do not often represent the way in which the individuals make decisions in real environments with natural stimuli. However, financial studies like Barberis, Shleifer et Vishny (1998), Kaestner (2006), Frieder (2008) et Alwathainani (2012) show that representativeness affects investors' behavior on stock markets and causes overreaction.

2.2. Stock market studies

To explain how representativeness causes overreaction, I will start with the overreaction definition provided by Barberis, Shleifer and Vishny (1998). According to these authors, overreaction means that the average return following a series of announcements of good news ($z_t = G$) is lower than the average return following a series of bad news announcements ($z_t = B$):

$$E(R_{t+1} / z_t = G, z_{t-1} = G, \ldots, z_{t-j} = G) < E(R_{t+1} / z_t = B, z_{t-1} = B, \ldots, z_{t-j} = B), \text{ Where } j \geq 1 \quad (1)$$

The explanation of this reversion is that after a series of good news, investors become overly optimistic that the future news announcements will be also good and, hence, overreact causing an overvaluation of the firm's stock price. They will be desperate once subsequent news announcements do not confirm their prior optimism, which leads to a price decrease below its fundamental value and, then, to poor returns. This reversion means that the overweighting of bad (good) information leading to a decrease (increase) in prices below (above) their fundamental value is corrected in subsequent period.

The explanation of the overreaction by the representativeness heuristic commonly provided by behaviorists (see for example, Barberis, Shleifer and Vishny, 1998) is as follows: When the investors realize that a firm has a history of either a remarkable or an exceptional performance (such as earnings or sales growth accompanied by an interesting description of its products and its management), they can deduce that such a history is representative of a good performance of the firm. Being unaware of the randomness of such a history, the investors believe that such a performance tends to be reproduced and that this firm will keep its earnings growth for a long time. Thus, they extrapolate its history far into the future. When anticipating the firm's share price, they overestimate it. They will be disappointed later when the earnings growth does not materialize as they were expecting. Consequently, stock prices decrease and revert back to their fundamental value.

To test the representativeness/overreaction hypothesis, Kaestner (2006) examined a sample of 4081 firms listed on NYSE, NASDAQ and AMEX over the period 1983-1999 and found that a series of similar past earnings surprises causes an increasing overreaction phenomenon which drives stock prices below their rational level after a series of negative past earnings surprises and above their rational level after a series of positive past earnings surprises. The magnitude of the market overreaction is positively related to the number of similar past earnings surprises, which means that investors tend to strongly extrapolate similar information under the representativeness effect.

Frieder (2008) analyzed aggregate order imbalance for firms having consecutive same-sign earnings surprises over the period 1988-1998. She found that the average daily order imbalance innovation increases with the number of positive surprises indicating that the investors buy significantly more stocks after series of positive surprises. She also found that excessive stock purchasing based on past earnings surprises is followed subsequently by underperformance. She concluded that investors extrapolate past performance to the point that they overreact.

Alwathainani (2012) found similar result based on series of similar past consecutive returns. He formed two portfolios : a consistent winner which includes firms that rank in the top 30% in terms of their returns over the past two, three and four months and a consistent loser which includes firms that persistently rank in the lowest quartile. He found for the period 1964-2008 that the consistent loser underperforms the consistent winner 1 year later, but

outperforms it 2, 3, 4 and 5 years later. The price reversals of the two portfolios increase with the length of the past series.

On the Taiwanese stock market, Wu, Wu and Liu (2009) found weak evidence of the representativeness over the period 1988-2006. They report, rather, a short-term predictability (for 3 to 12 months) explained by underreaction to earnings announcement due to the conservatism bias.

The explanation of the overreaction by representativeness relies on the concept of sentiment of excessive optimism or pessimism (see the definition above of overreaction provided by Barberis, Shleifer and Vishny, 1998). Several studies were interested in the impact of investor sentiment on the financial markets without associating it with the representativeness heuristics. In this paper I will try to show how representativeness causes optimism or pessimism and then, overreaction.

3. Research design

The main objective of this empirical research is to know whether the representativeness heuristic causes overreaction of the Tunisian stock market to the informational content of earnings. To do so, I proceed in two stages. In their definition of the overreaction, Barberis, Shleifer and Vishny (1998) underlined the representativeness effect on the investor sentiment (its optimism or pessimism) which causes, in turn, an under-or overvaluation of stocks corrected subsequently by a reversion to its rational level. Thus, it would be appropriate to examine first the impact of unexpected earnings on the investor sentiment, source of this overreaction. This allows us to know if a series of unexpected earnings (or earnings surprises) creates a sentiment of optimism or pessimism that affects the investor judgment as regards to stock valuation.

Given that a misevaluation (undervaluation or overvaluation) of stock price is corrected later, we should find a negative relation between a series of similar past earnings surprises and future stock returns. The second stage examines this relation.

3.1. Impact of the representativeness heuristic on investor sentiment

I formally state the first hypothesis of representativeness/sentiment as follows:

H1: "*The past unexpected earnings affect the sentiment of investors subjects to the representativeness heuristic"*

To test the impact of earnings surprises on investor sentiment, two methods will be adopted: (i) a Granger (1969) causality test between "earnings surprises" and "investor sentiment"; and (ii) an event study which examines the sentiment evolution following earnings announcement.

3.1.1. Granger causality tests between unexpected earnings and investor sentiment

To run Granger causality test between "unexpected earnings" and "investor sentiment indicator", the following vector autoregression (VAR) is considered:

$$\begin{cases} Sent_t = \alpha_1 + \sum_{j=1}^{p} \beta_{1j} UE_{t-j} + \sum_{j=1}^{p} \gamma_{1j} Sent_{t-j} + \varepsilon_{1t} \\ UE_t = \alpha_2 + \sum_{j=1}^{p} \beta_{2j} UE_{t-j} + \sum_{j=1}^{p} \gamma_{2j} Sent_{t-j} + \varepsilon_{2t} \end{cases} \quad (2)$$

Where $Sent_t$ is the investor sentiment indicator measured by ARMS index and UE_t, the unexpected earnings.

If the representativeness affects the investor sentiment, one must expect that Only the variable "unexpected earnings" Granger causes "the investor sentiment". Causality from the investor sentiment to the unexpected earnings or bidirectional causality will be considered as evidence against this hypothesis.

The causality tests inform us only whether a series of earnings surprises has an impact on the investor sentiment, but it does not allow to identify the nature of the sentiment (i.e. whether it is optimism or pessimism), nor the

magnitude of this sentiment (i.e. whether it is excessive or not). These two characteristics could be highlighted through an event study.

3.1.2. Event study

Since the earnings of the most Tunisian companies are generally annual, the unexpected earnings computed must also be annual. I have, then, to calculate an annual indicator of sentiment to be able to test the preceding VAR model. However, the calculation of a sentiment indicator over a period as long as one year alters its precision, which can bias the results resulting from Granger causality test. So, I run an event study which allows to thoroughly calculate a sentiment indicator for various windows. The investor sentiment (ARMS index) is calculated *T* days after the earnings announcement (*T = 5, 7, 10, 20, 30, 60, 90 and 120 days)* and then, its average over the sample period.

As mentioned above, the event study has the advantage to allow, based on the investor sentiment level, to judge if the Tunisian investor is optimistic or pessimistic about the firms' future prospects and whether this optimism or pessimism is excessive (see interpretation of ARMS index in section 3.3.2).

3.2. Impact of the representativeness heuristic on the investor behavior

Under the effect of representativeness, similar information can be perceived as representative of a firm's performance and extrapolated too far into the future. The investors subjects to this heuristic overestimate recent and salient information when evaluating the future performance of the firms. It means that they overreact to this information. Consequently, firms that have a long series of good (bad) news concerning unexpected earnings can exhibit a more significant overreaction and finish to be strongly overestimated (underestimated). According to Kaestner (2006), this effect implicitly assumes the existence of an external event that stops the overreaction behavior. Dealing with earnings news, this can be an announcement which infirms the investors' expectation and generate, consequently, a reversion phenomenon. This reversion means that the past overreaction is subsequently corrected. Therefore, to examine whether the representativeness causes investor overreaction to new information, the two following hypotheses are tested.

3.2.1. Investors' overreaction to unexpected earnings

The investors who apply the representativeness heuristics extrapolate their information far into the future. When these extrapolations are not confirmed by next earnings announcement, there should be later a reversal. After a positive surprise, the investors are expected to overestimate the next period earnings. On average, significant unexpected earnings should be followed, at the next earnings announcement date, by a correction of the initial overreaction, i.e. followed by Cumulative Abnormal Returns (CAR) of the opposite sign. This hypothesis can be stated as follows:

H2. *"High unexpected earnings event causes an overreaction phenomenon followed by a performance reversal at the next earnings announcement"*

3.2.2. Increasing overreaction to similar unexpected earnings

In their definition of the overreaction phenomenon, Barberis, Shleifer and Vishny (1998) underlined that the source of overreaction is a series of similar information and not one piece of information. Similarly, Bloomfield and Hales (2002), Kaestner (2006), Alwathainani (2012) and Frieder (2008) have shown that the magnitude of the overreaction increases with the information persistence. It is thus, obvious, that a repeatedly-confirmed information affects the investor behavior more than the information communicated separately, because it creates in their minds, according to Kaestner (2006), an image more representative of the firm performance which affects their judgment of its future performance. Repeatedly confirmed information is, thus, extrapolated more strongly than less frequent information. Consequently, the longer the similar earnings surprise series, the stronger is the investor overreaction. It is, thus, appropriate to test the following hypothesis:

H3. *"The longer the series of similar unexpected earnings, the higher the subsequent correction of biased prices will be"*

3.3. Data, methodology and descriptive statistics

3.3.1. Data

To test the preceding hypothesis, we need stock market data and accounting data. The stock market data are the daily stock price, the trading volume (number of shares traded in a day) and the number of outstanding shares of all the firms listed on the Tunisian stock market on the period January 1990 - June 2010. The accounting data are annual earnings, total assets and earnings announcement dates. For these data, I went back to 1986 to take account of the series of earnings change preceding the year of 1990. Over the period 1986-2010, I collected 770 annual earnings announcements.

3.3.2. The variables

Unexpected earnings

The key element in the study of the representativeness impact on the stock market prices is the new information communicated by earnings. This new information takes the form of the unexpected earnings (or surprise). To isolate this information, empirical studies subtract the earnings expected by the market from the actual earnings. These studies often use *consensus analysts' forecasts of earnings* as proxy for the expected earnings. However, if the consensus analysts' earnings are not available, Nichols and Wahlen (2004) recommend the use of prior-period earnings as an estimate of expected earnings. Earnings surprises or unexpected earnings are, then, proxied by earnings change:

$$UE = \Delta E_i\,(n) = E_i(n) - E_i(n-1) \tag{3}$$

Where *UE* denotes Unexpected Earnings, $E_i(n)$ is the current earnings and $E_i(n\text{-}1)$ is the prior period earnings of firm *i*.

Following Nichols and Wahlen (2004), I use, also, earnings change per total assets to enhance the cross-sectional comparability of this measure. Firms are ranked into three groups conditional on this measure.

$$UE = \frac{\Delta E_i\,(n)}{TA_i(n\text{-}1)} \tag{4}$$

Where *UE* is Unexpected Earnings; $\Delta E_i(n)$, current earnings change; and TA_i(n-1), prior year firm *i*'s total assets.

The investor sentiment measure: ARMS index

To measure the investor sentiment, I will use the ARMS index which is one of the most used technical indicators. In our study, we use only ARMS index as a sentiment indicator because the other indicators enumerated in the financial literature are not applicable to the Tunisian context, either because there are no data on these types of indicators such as those obtained from surveys or because there are no data allowing us to calculate some indicators such as the Put/Call ratio.

Created by Richard Arms (1989), ARMS index at date *T* is defined as the ratio of the number of advancing stocks to the number of declining stocks standardized by their respective trading volume.

$$ARMS_t = \frac{N\ adv_t / Vol\ adv_t}{N\ dec_t / Vol\ dec_t} = \frac{Vol\ dec_t / N\ dec_t}{Vol\ adv_t / N\ adv_t} \tag{5}$$

Where, *N adv* is the number of advancing stocks; *Vol adv* trading volume of advancing stocks; *N dec,* number of declining stocks and; *Vol dec,* trading volume of declining stocks.

ARMS index can be interpreted as the ratio of volume per declining stock to the volume per advancing stock (Wang, Keswani and Taylor, 2006). It indicates that when the average trading volume of declining stocks exceeds the average trading volume of advancing stocks (i.e. ARMS>1), the market is oversold. On the other hand, if the average trading volume of rising stocks exceeds the average trading volume of decreasing stocks (ratio ARMS<1), the market is overbought (Brown and Cliff, 2004, 2005 and; Wang, Keswani and Taylor, 2006).

Abnormal returns

To compute the abnormal returns I use, according to Foster, Olsen and Shevlin (1984), Bernard and Thomas (1989), Nichols and Wahlen (2004) and Kaestner (2006), a size-adjustment approach. At the beginning of each year, I group the firms in three portfolios based on their market value (a stock's price times shares outstanding), and I calculate the equally-weighted return of each portfolio which noted $R_{size,t}$. For each stock, the abnormal return at date t is the difference between the stock return at date t and the equally-weighted return of the portfolio to which it belongs at the beginning of the year.

$$AR_{i,t} = R_{i,t} - R_{size,t} \quad (6)$$

Where; $R_{i,t}$ is stock i's return at time t and $R_{size,t}$ is the equally weighted return of the portfolio "*size"* to which the stock i belongs at the beginning of the year.

The abnormal returns are then cumulated over the period following and including the earnings announcement date:

$$CAR_i(T) = \sum_{t=0}^{T} AR_{i,t} \quad (7)$$

T is the length (expressed in days or months) of the period over which the abnormal returns are cumulated after (and including) the earnings announcement date.

I use daily and monthly observation for the abnormal and cumulative abnormal returns. Theoretically, daily observations are appropriate for event studies because they allow observing the market reaction following earnings announcement with higher precision than in the case of monthly frequency. I also use monthly data to avoid certain measurement problems that can arise with the use of daily data such as the "bid-ask" effect and the consequences of infrequent trading.

3.3.3. Descriptive statistics

Table 1 presents some descriptive statistics for the annual variables and for daily and monthly abnormal returns for some windows T. The statistics corresponding to the earnings and earnings change, for example, indicate that during most of the sample period, firms were profitable.

Table 1. Descriptive statistics

	Mean	Std. Dev.	1st Quartile	Median	3rd Quartile
Panel A. Annual Sample					
Market Value (Million TND)	85.859	115.446	17.040	37.590	114.051
Earnings (Million TND)	5.376	13.988	1.049	2.895	7.669
Earnings changes (Million TND)	0.614	14.278	-0.321	0.334	1.317
Total Assets (Million TND)	1075.881	12658.888	40.960	92.870	778.761
(ΔE)/T.A	0.007	0.113	-0.003	0.002	0.010
Panel B. Monthly variables					
Returns	0.0032	0.1242	-0.0278	0.0000	0.0358
AR(9 months)	0.0000	0.1091	-0.0353	-0.0004	0.0374
CAR (9 months)	-0.0002	0.2616	-0.0760	0.0133	0.1103
Panel C. Daily variables					
AR (10 days)	0.0000	0.0235	-0.0043	0.0001	0.0059
AR (30 days)	0.0000	0.0343	-0.0040	0.0002	0.0055
AR (60 days)	0.0000	0.0318	-0.0040	0.0000	0.0049
CAR (10 days)	0.0004	0.0528	-0.0154	0.0000	0.0179
CAR (30 days)	0.0005	0.0963	-0.0281	0.0013	0.0324
CAR (60 days)	0.0008	0.1622	-0.0382	0.0038	0.0555

Notes: Market Value is the stock's price at the beginning of the year times number of shares outstanding. Earnings change is the difference between current year earnings and prior year earnings. The annual Sample includes 770 earnings announcements on

period 1986-2010. AR and CAR are Abnormal Returns and Cumulative Abnormal Returns, respectively, computed for various event windows.

4. Empirical results

4.1. Does the representativeness affect the investor sentiment?

4.1.1. Causality test

The parameters of VAR can only be estimated on stationary time series. The stationarity test of the two series "ARMS" and "earnings change" shows that they are stationary in level.

Table 2 presents the results of Wald tests for optimal lag equal to 2 (based on Schwarz criterion) performed to test, first, the null hypothesis that for example $\beta_{11}=\beta_{12}=0$, second, the null hypothesis that the sum of estimated coefficients, for example $\beta_{11}+\beta_{12}$, is equal to zero. The sum of the unexpected earnings coefficients in the first equation of the VAR model represents the cumulative effect of lagged unexpected earnings on the investor sentiment. The first test is a joint test which examines the simultaneous significance of many coefficients in an equation. The second test examines whether the sum of these estimated coefficients are significantly different from zero. F_1 and F_2 statistics are used to test these null hypotheses, respectively (Tests based on $\chi 2$ statistics give similar results). The *p-value* is the probability of each statistic under the null hypothesis.

The first column of the table displays *F* statistic for the unexpected earnings coefficients and their corresponding probabilities. It shows that the null hypothesis "The unexpected earnings do not Granger cause ARMS index" is rejected at the 5% level. In the same way, the second test indicates that the null hypothesis is rejected since the probabilities of the corresponding test statistics (4.44%) are lower than 5%. There is, thus, a significant positive cumulative effect of lagged earnings surprises on the ARMS index which indicates that a series of past earnings surprise affects significantly the investor sentiment. In addition, the estimate of the second equation shows that the null hypothesis cannot be rejected at conventional significance level implying that "investor sentiment" (ARMS index) does not Granger cause "earnings surprises". Thus, the investor sentiment measured by ARMS index does not provide any useful information content to forecast unexpected earnings.

Similar results, available on request, were found for lags 1 and 3. In sum, these results show that the representativeness can affect the mood of the Tunisian investors by creating a sentiment of optimism or pessimism which can cause overreaction to earnings announcement.

Table 2. Granger Causality between earnings surprises and investor sentiment

Dependent variable	$ARMS_t$		ΔE_t	
Independent variable	ΔE_{t-j}	$ARMS_{t-j}$	ΔE_{t-j}	$ARMS_{t-j}$
F_1 [*p-value*]	6.2397	0.5560	0.0380	0.1908
	[0.0139]	[0.5876]	[0.9628]	[0.8287]
Sum of lagged coefficients	20.5653	-0.1928	0.0083	-0.0128
F_2 [*p-value]*	5.0409	0.2584	0.0002	0.3624
	[0.0444]	[0.6204]	[0.9874]	[0.5584]
	$\overline{R}^2 = 0.361$		$\overline{R}^2 = -0.274$	
	Prob(F) = 0.0497		*Prob(F) = 0.9647*	

Notes: ΔE_{t-j} is the unexpected earnings compounded as the value-weighted earnings change of firms selected at each period. F_1 and F_2 are obtained from a Wald test: The F_1 test statistic is a joint test of the null hypothesis based on Granger causality restrictions. *p-value* is the probability of the F statistic under the null hypothesis. The F_2 test statistic is used to test the null hypothesis that the sum of the estimated coefficients is equal to zero. *p-value* is the probability of the F2 test statistic under the null hypothesis.

4.1.2. Event study

Table 3 presents the evolution of the investor sentiment measured by ARMS index after earnings announcement. The ARMS index is always significantly different from 0 for various windows, confirming the impact of the unexpected earnings on the investor sentiment deduced from the causality test. The index is always higher than 1 indicating a sentiment of pessimism. This means that the Tunisian investors are not generally satisfied with the

announced earnings. This sentiment is excessive 20 and 30 days after earnings announcement where volume per decreasing stock is almost twice the volume per increasing stock.

Table 3. ARMS index *d* days following earnings announcement date

Days	5 d	7 d	10 d	20 d	30 d	60 d	90 d	120 d
ARMS	1.369	1.386	1.282	1.846	1.899	1.422	1.496	1.437
	(5.87)	(4.22)	(5.21)	(4.60)	(3.96)	(5.59)	(3.59)	(4.76)

t-statistics are in parentheses

In Sum, results based on causality test and event study confirm our first hypothesis according to which the representativeness affects the investor sentiment.

Now, I am going to examin the reaction of the market to one earnings surprise and to a series of similar earnings surprises.

4.2. Does the representativeness explain the investors' overreaction to earnings surprises?

4.2.1. Impact of a past surprise on the market reaction

To test the second hypothesis, firms are grouped in two portfolios based on their past earnings change, *ΔE(n -1)*. The first portfolio (P+) consists of the firms having a positive earnings change and the second one (P -) consists of those having a negative earnings change. Firms are also ranked based on earnings change to total assets, *ΔE(n-1)/TA*, where P1 is the portfolio of the 1/3 of firms having the highest past earnings change per total assets and P3 is the portfolio of the 1/3 of firms having the lowest past earnings change per total assets. Abnormal returns are, then, cumulated starting from the next earnings announcement date. Abnormal return of a portfolio is the equally weighted abnormal returns of the stocks belonging to it. I calculate the average of the cumulative abnormal returns across all the 20 years in my sample period.

The hypothesis H2 states, as explained previously, that the current cumulative abnormal returns, *CAR*, should be of the opposite sign to the past earnings surprise, *ΔE (n-1)*. The results obtained with monthly cumulative abnormal returns (table 4) partially confirm this hypothesis. It was found that only those corresponding to the firms having extremely positive earnings change (tercile 1 obtained based on *ΔE/TA)* are significant and of the opposite sign than the lagged variable *ΔE(n-1)/TA*. After an extremely positive surprise, the investors seem to be disappointed about the recent earnings, which results in significant negative cumulative abnormal returns varying from -0.76% (t = -1.76) at the month of announcement to -3.54 % (t = -2.12) nine months after the announcement date. The profit of a contrarian strategy which consists in buying stocks having experienced extreme negative earnings changes, selling those having experienced extreme positive earnings changes, and reversing these positions later, is positive, but not significant. The absence of significance is probably due to the non reversal of the performance of the firms having experienced extreme negative earnings (portfolio 3). This partial reversion is in line with the results of Frieder (2008) who finds that investors extrapolate mainly positive earnings surprises into the future.

Table 4. Monthly cumulative abnormal returns following past unexpected earnings

	ΔE			***ΔE/TA***		
Prtf	P^+	P^-	$P^- - P^+$	***P1***	***P3***	***P1- P3***
CAR(0)	-0.10%	-0.29%	-0.19%	-0.76%*	-0.35%	0.41%
CAR(1)	-0.19%	-0.33%	-0.14%	-1.92%	0.54%	2.45%
CAR(2)	-0.29%	-1.62%	-1.33%	-2.53%*	-0.51%	2.03%
CAR(3)	-0.33%	-2.53%	-2.20%	-3.26%*	-1.87%	1.39%
CAR(4)	0.01%	-2.37%	-2.39%	-3.04%*	-1.81%	1.23%
CAR(5)	-0.12%	-2.37%	-2.25%	-3.46%**	-1.83%	1.64%
CAR(6)	0.10%	-2.03%	-2.13%	-3.21%*	-2.17%	1.04%
CAR(7)	0.45%	-1.87%	-2.32%	-2.77%	-2.54%	0.24%
CAR(8)	0.15%	-1.95%	-2.10%	-2.79%*	-2.92%	-0.13%
CAR(9)	-0.21%	-0.78%	-0.57%	-3.54%**	-1.69%	1.84%
CAR(10)	0.26%	-1.76%	-2.02%	-2.83%*	-1.82%	1.02%

CAR(11)	0.24%	-0.91%	-1.15%	-4.17%**	-1.55%	2.62%
CAR(12)	0.67%	-1.32%	-1.99%	-3.52%	-1.64%	1.88%

Notes. Stocks are ranked based on past unexpected earnings, UE_{n-1}. Unexpected earnings are measured by earnings changes ΔE or by earnings changes scaled by lagged total assets $\Delta E/TA$. The later is used for cross-sectional comparability. P+ and P- are portfolios of all firms having positive past earnings change and those having past negative earnings change, respectively. P1 (P3) is the portfolio of the 1/3 of firms having the highest (lowest) past earnings change per total assets. Cumulative abnormal returns are obtained by summing monthly abnormal returns for each window following and including the earnings announcement date and averaged across all 19 years in our sample period. ***, ** and * indicate significance at 1%, 5% and 10 % level respectively.

This result seems to partially confirm the representativeness hypothesis as a potential explanation to the overreaction phenomenon on the Tunisian stock market. However, it does not exclude, according to Kaestner (2006), the fact that abnormal returns are a purely rational response to the current unexpected earnings. This is the case if the successive earnings surprises are negatively correlated; i.e. after a positive surprise, there will be on average a negative current surprise followed by negative abnormal returns. Bernard and Thomas (1989), for example, found an earnings surprises' autocorrelation in the American context.

Table 5 presents the coefficient of correlation ρ between the current earnings surprises and the past earnings surprises for lags 1, 2, 3 and 4. $\Delta E/TA$ does not seem to provide a conclusive result which can be considered in our analysis since none of the autocorrelation coefficients is significantly different from zero. However, when the earnings surprises are measured by earnings changes, a significant negative autocorrelation is found between ΔE_n and ΔE_{n-1} of -0.411(t = 11.451). For lag 2, this autocorrelation is weak but significant, -0.102 (t = 2.477). Consequently, the partial reversal observed previously is rational and cannot be explained by the representativeness heuristic.

Table 5. Earnings surprises autocorrelation

Unexpected Earnings	(n ; n-1)	(n ; n-2)	(n ; n-3)	(n ; n-4)
$\Delta E/TA$	-0.033	-0.008	0.001	-0.033
	(0.790)	(0.186)	(0.031)	(0.690)
ΔE	-0.411	-0.102	-0.057	-0.059
	(11.451)	(2.477)	(1.298)	(1.281)

t-statistics are in parentheses

4.2.2. Impact of a series of similar past surprises on the market reaction

The objective of this section is to examine the link between a series of similar surprises and the future returns. This enables us to identify, as underlined by Kaestner (2006), the marginal impact of an additional similar past surprise on the overreaction magnitude. If this overreaction is due to the representativeness, then the investors would not only extrapolate a one earnings change in the future, but he would also strongly react to a series of similar surprises. If the investors use the representativeness heuristic, one must expect that the subsequent reversion is more pronounced for the events having a long series of good or bad surprises.

Table 6 displays the monthly cumulative abnormal returns following current earnings surprise preceded by earnings surprise of the opposite sign. The sign " + " corresponds to a positive earnings surprise. The sign " - " corresponds to a negative earnings surprise. The second column (P+) represents the cumulative abnormal returns following a positive current earnings surprise. We continue with only earnings change as proxy of earnings surprises to get maximum number of firms matching the criteria of 1, 2 and 3 similar past earnings. The sixth column (P-) presents the cumulative abnormal returns following a negative current earnings surprise. Note that the cumulated abnormal returns are of the same sign than the current surprise and are, generally significant. This positive association between the current earnings surprise and the abnormal returns, which indicate that stock returns are adjusted in the same direction that the earnings surprise, corroborate the results found by Ball and Brown (1968) and Nichols and Wahlen (2004) on the American stock market.

Table 6. Monthly cumulative abnormal returns following a series of similar past unexpected earnings

	Positive ΔE preceded by 1, 2 or 3 negative ΔE				Negative ΔE preceded by 1, 2 or 3 positive ΔE			
Prtf	P+	P- +	P- - +	P- - - +	P-	P+ -	P+ + -	P+ + + -
CAR(0)	0.55%**	1.65%**	2.05%	1.64%	-1.38%***	-0.83%	1.03%	1.75%
CAR(1)	0.81%*	2.49%*	3.71%**	4.78%	-1.15%	-0.86%	2.61%	5.24%**
CAR(2)	0.97%	1.92%	1.71%	4.46%	-1.26%	-0.54%	1.73%	6.44%**
CAR(3)	1.27%*	0.48%	0.50%	-0.01%	-2.35%	-2.83%	1.11%	4.84%
CAR(4)	1.07%	-0.33%	1.06%	-3.00%	-2.01%	-2.30%	2.48%	6.25%*
CAR(5)	1.54%**	-0.09%	0.54%	-0.96%	-3.00%**	-4.44%	-0.20%	4.66%
CAR(6)	1.76%**	0.38%	1.47%	1.91%	-3.06%*	-4.29%	0.55%	4.12%
CAR(7)	1.75%**	1.87%	3.63%	7.56%	-2.50%	-2.05%	2.23%	4.32%
CAR(8)	2.58%***	4.33%	7.00%	9.03%	-4.59%***	-3.68%	2.00%	4.77%
CAR(9)	2.73%***	6.24%	7.96%	11.19%	-5.04%***	-5.04%*	-1.20%	3.60%

Notes. Firms are first ranked based on current earnings changes ΔE_n. P+ (P-) is portfolio of all firms having a positive (negative) ***current*** earnings change. Second, Other Portfolios are formed conditional on the number of similar ***past*** earnings changes : P- +, P- - + and P- - - + are portfolios of firms having current positive surprise preceded by 1, 2 and 3 negative surprises, respectively and P+ -, P+ + - and P+ + + - are portfolios of firms having current negative surprise preceded by 1, 2 and 3 positive surprises, respectively. Cumulative abnormal returns are obtained by summing monthly abnormal returns for each window following and including the earnings announcement date and averaged across all 19 years in our sample period. ***, ** and * indicate significance at 1%, 5% and 10 % level respectively

P- +, P - - + and P - - - + are the portfolios of firms having a positive current surprise preceded by one, two and three negative surprises, respectively. P+ -, P+ + - and P+ + + - are the portfolios of firms having a negative current earnings surprise preceded, respectively, by one, two and three positive surprises. The results presented in this table do not sufficiently support the hypothesis H3 for three reasons:

i) We must focus, first of all, on firms having a series of bad news for the following reasons. Recall that the causality test revealed a significant cumulative effect of two past surprises (for an optimal lag p = 2) on the investor sentiment (see table 2) and that the event study indicated that the investor sentiment reigning on the Tunisian stock market is, in general, a sentiment of pessimism (see table 3). Therefore, one must expect that after two negative past surprises the investors become excessively pessimistic and consequently, they overreact to this series of bad news by causing an undervaluation of the shares of these firms. If these two negative surprises are followed by a positive surprise, the investors revise their anticipations, resulting in a price increase and, hence, in positive returns. Column 4 of table 6 shows that the cumulative abnormal returns are positive but significantly different from zero only 1 month after a positive earnings surprise (CAR(1) = 3.71% (t = 2.18)).

ii) The degree of the investor overreaction does not generally increase with the length of the series of earnings surprises. The only exceptions correspond to the abnormal returns at the month of announcement (T = 0) and one month after earnings announcement (T = 1) for the firms having a positive current earnings surprise. In the month of announcement, the reaction of the market following a positive current surprise preceded by a negative past surprise is higher than that of only one positive current surprise (1.65% > 0.55%). One month later, the abnormal returns increase from 0.81% (t = 1.65) for a positive current surprise to 2.49% (t = 1.85) for a positive current surprise preceded by a negative surprise, then, to 3.71% (t = 2.18) for a positive current surprise preceded by 2 negative surprises. For 3 negative surprises, the reaction of the market is higher but not significant, probably because of the low number of the firms belonging to this portfolio (i.e. firms having jointly a positive surprise preceded by three negative surprises).

iii) The abnormal returns of firms having negative current surprises are not significant when a negative surprise is preceded by one or more positive surprises.

These results do not corroborate those of Kaestner (2006) on the American market, do not support the experimental study of Bloomfield and Hales (2002) and do not validate the model of Barberis, Shleifer and Vishny (1998) in the Tunisian context.

5. Conclusion

The representativeness heuristic means that, under uncertainty, the investors tend to believe that a history of a remarkable performance of a given firm is "representative" of a general performance that the firm will continue to generate in the future. The investors subjects to this heuristic react with a sentiment of excessive optimism (pessimism) to a series of good (bad) news and extrapolate, thus, the past performance of the firm into the future by causing stock overvaluation (undervaluation). This means they overreact to similar information. The objective of this paper was to examine this link on the Tunisian stock market by focusing on accounting earnings announcement as an event that could cause a potential overreaction.

Although the representativeness heuristic affects the investor sentiment (by creating a sentiment of pessimism), I have found a weak evidence supporting the hypothesis according to which this sentiment explains the investors overreaction to the informational content of earnings. Rather, the negative earnings surprises autocorrelation predicts a rational behavior.

In this paper, I tried to explain the investor overreaction by the representativeness heuristic. However, the behavioral literature refers to two other biases which can account for it: the self-attribution and the overconfidence (see, for example, Gervais and Odean, 2001; Chuang and Lee, 2006; Darrat, Zhong and Cheng, 2007; and Chou and Wang, 2011). This literature suggests that investors overreact to their private information and underreact to public information. Thus, it would be appropriate to explore this perspective.

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