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Anomalous Price Behavior Following Earnings Surprises: Does Representativeness Cause Overreaction?

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1. Introduction

Over the last two decades, both theoretical and empirical work from the field of what is commonly called behavioral finance, has presented an important challenge to the traditional finance paradigm, which states that investors behave fully rationally. Although this appears to be very desirable, extensive theoretical and experimental evidence suggest systematic biases to rationality.

In fact, empirical research in finance has uncovered two families of pervasive regularities: short-term underreaction to news, such as earnings figures, showing that prices reflect new information only slowly, and long-term overreaction, where stock prices exhibit negative autocorrelations.

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The paper is organized as follows: the remainder of this introduction provides a short review of Behavioral Finance literature that deals with the underreaction and overreaction/representativeness phenomena. The data and research methodology is exposed in section 2. Section 3 presents the main results.

1.1. The underreaction phenomenon

A large body of literature has examined stock price underreaction to corporate announcements and events, such as earnings announcements, dividend initiations or omissions and public offerings. Since Ball and Brown, the Post-Earnings-Announcement-Drift (PEAD) has become one of the most famous stock market anomalies[1]. Many theories have been advanced to explain the slow adjustment of stock prices to recent and publicly available earnings information. Among them, the role played by individual investors (Hirshleifer, Myers, Myers, and Teoh, 2003), illiquidity issues (Sadka, 2005) and analyst related issues: low analyst coverage (Hong, Lim, and Stein, 2000) or analyst underreaction to extreme bad news (Easterwood and Nutt, 1999), causing market underreaction. Very recently, Frazzini (2006) re-opened the path for a behavioral explanation of the phenomenon. He shows that the disposition effect, that is, the tendency of investors to ride losses and realize gains, is a potential explanation for the post-earnings-announcement-drift. Investors having experienced gains and facing positive news are more incline to take their gains, thus delaying the information dissemination.

Other studies, beginning with Jegadeesh and Titman (1993) have examined stock price underreaction and possible explanations. In their study, stocks are ranked into portfolios based on their prior six-month return. Unlike De Bondt and Thaler (1985)'s finding, prior winners outperform prior losers over the following 6-month period. This "momentum effect" was confirmed by Lee and Swaminathan (2000) and Jegadeesh and Titman (2001). Chan, Hammed, and Tong (2000)

1. See Bernard and Thomas (1990), Chan, Jegadeesh, and Lakonishok (1996) for tests on more recent data, Kothari (1997) for a review of empirical research and Fama (1998) for a discussion of the anomaly.

examine 23 international stock market indices and report a short-run momentum. Although some methodological issues were mentioned (momentum larger in small firms (Jegadeesh and Titman, 1993; Grinblatt and Moskowitz, 1999) and in growth firms (Daniel and Titman, 1999)), the anomaly has proved robust.

1.2. The overreaction phenomenon

Investors' overreaction to information seems to be the main conclusion of the seminal De Bondt and Thaler (1985)'s study. The authors rank all stocks traded on the NYSE over the period 1926-1982 by their past three year cumulative return. Subsequent abnormal performance turns out to be higher for prior "losers", that is, stocks having experienced the poorest past performance. Over the subsequent three years, the bottom decile portfolio yields an abnormal return 8% higher than that of the top decile portfolio: the prior winners. This stock return reversal suggests that part of an initial overweighing of negative (positive) stock information, driving prices below (over) their rational levels, is subsequently corrected.

The overreaction phenomenon has been confirmed several times on the stock market (De Bondt and Thaler, 1987; Chopra, Lakonishok, and Ritter, 1992), but also for international stock market indices (Chui, Titman, and Wei, 2000; Bhojraj and Swaminathan, 2001), the gold market (Cutler, Poterba, and Summers, 1991) and the options market (Poteshman, 2001). Although this anomaly is now well established in empirical finance, the question of what drives overreaction still remains unanswered. Many authors condition their studies on past performance (De Bondt and Thaler, 1985; Chopra, Lakonishok, and Ritter, 1992), current earnings (De Bondt and Thaler, 1987) and forecasted changes in earnings (De Bondt and Thaler, 1990) and invoke the "representativeness bias" as a potential explanation, without directly testing for it. At the time of this writing, only Poteshman (2001) lines up representativeness and overreaction by investigating the response of option market investors to changes in the instantaneous variance of the underlying asset.

1.3. The representativeness heuristic

Most of the empirical studies that deal with overreaction use past stock returns as a proxy for prior information. In the common portfolio-approach, stocks are ranked according to this past performance, then top and bottom decile past performers are simply compared to each other. The aim of this study is on what's behind the mirror. As investors seem to overreact to some information, that, in turn, influences stock returns, it is crucial to the general acceptance of investor psychology as a determinant of asset prices to investigate *what* they overreact to. This work aims to provide evidence that overreaction is rather due to earnings information than to past stock performance, even if both phenomena are undoubtedly related. Its results hopefully reconcile the overreaction phenomenon and the representativeness bias.

Representativeness involves assessing "*[...] the probability of an uncertain event, or a sample, by the degree to which it is similar in its essential properties to the parents' population [...]*"[2]. In other words, people rely too heavily on information gathered from small samples (the so-called "law of small numbers", introduced by Tversky and Kahneman (1971)) and underestimate statements about unconditional probability – the Bayesian prior probability.

Representativeness can have two effects. On one hand, a series of similar information may be considered as a pattern, and extrapolated too far into the future. Doing so, people overweight recent salient news when estimating future stock performance: they overreact. *Ceteris paribus*, securities, which have a *long* record of good (bad) earnings surprises may experience an even higher overreaction and end up highly overpriced (underpriced). On the other hand, a series of similar information can make individuals expect a *reversion to the mean*, even if the series is too short for that law to apply. In this context, contrarian strategies (buying stock having performed badly and selling those having performed well) may be profitable.

The first effect focuses on the source of overreaction and implicitly supposes an external event that stops the overreaction phenomenon. In the earnings announcement framework, this could be a disconfir-

2. Tversky and Kahneman (1974).

ming information disclosure, initiating a reversal phenomenon. The second effect directly addresses the issue *why* a reversal phenomenon should take place. Accordingly, a reversal could be initiated without any further piece of information, only by the existence of a series of positive (or negative) earnings surprises. This study explicitly tests the first effect, supposing that investors globally correct any prior overreaction at the time of arrival of new earnings information. Of course, if the tests do not indicate any significant market reaction, consistent with the way, I formulated the overreaction/representativeness hypothesis, it would imply either the absence of any overreaction to earnings surprises, or the presence of traders implementing contrarian strategies. Although latter cannot be excluded in any case, the results reveal a strong reversal after series of similar surprises at the time of a subsequent earnings announcement; they indicate that the "first" effect of representativeness is at least strong enough to be statistically detected.

2. Data, methodology and descriptive statistics

2.1. Data

The sample is made of companies traded on American Financial Markets (NYSE, NASDAQ, AMEX) over the period from January 1st, 1983 to December 31st, 1999. Financial analysts' earnings forecasts and actual earnings were provided by the I/B/E/S summary file. Return data is obtained from the Center of Research in Security Prices Daily Stocks File (CRSP).

For each quarterly earnings announcement made by any company over this period, the consensus earnings estimate from the month preceding the earnings announcement and the actual earnings per share (*EPS*) are collected. To allow for a time-line analysis, EPS estimates and their actual value for each of the 4 preceding quarters were also obtained. Moreover, for each earnings announcement, return data for the 60 trading days following the actual announcement date were extracted from CRSP.

Quarterly earnings, earnings announcement dates and estimates were not available for all companies in all quarters. Also, a few companies could not be found in CRSP and were deleted. The final sample consists of 79 289 earnings announcements for 4 081 companies[3].

2.2. Computing standardized unexpected earnings

As will be shown later, detecting overreaction to past earnings surprises requires a measure of the degree of consensus among analysts at one point in time. For this reason, I use the latest consensus estimate before an announcement instead of the last individual estimate or an average of individual estimates preceding the announcement, that are sometimes used in similar studies.

For a given quarter q, *unexpected earnings* (UE_q) equal the difference between actual earnings (EPS_q) and the consensus estimate in the month preceding the actual announcement (EST_q):

$$UE_q = EPS_q - EST_q \tag{1}$$

In order to identify highly unexpected earnings, I compute *standardized unexpected earnings* (SUE_q) by dividing the unexpected earnings (UE_q) by the standard deviation of the consensus forecast (σ_{EST_q}). In this manner, I capture the degree to which analysts (and the market) agree on a given earnings estimate:

$$SUE_q = \frac{UE_q}{\sigma_{EST_q}} \tag{2}$$

When analysts disagree on earnings forecasts, the standard deviation of estimates within a monthly consensus is high. In the case of high uncertainty, that is, low consensus among analysts, the degree to which actual earnings are considered as unexpected (the *SUE* measure) would be rather low. Conversely, the higher the consensus among analysts, the lower the consensus standard deviation, which results in a higher surprise for a given level of unexpected earnings. It follows that

3. I did not impose any condition on return data for the preceding 4 quarters. As a consequence, an event enters the sample as long as 5 consecutive quarters are available through I/B/E/S and return data is available for the most recent quarter.

standardized unexpected earnings measure the *strength* in which the actual earnings differ from their estimate.

2.3. Computing abnormal returns

Daily abnormal returns are computed using a size-adjusted approach (following Bernard and Thomas (1989)) in order (1) to avoid the *bad model* issue, commonly addressed in Behavioral Finance and (2) to keep the results comparable to those found in previous literature (Lakonishok, Shleifer, and Vishny, 1994; Bernard, Thomas, and Whalen, 1997; La Porta, Lakonishok, Shleifer, and Vishny, 1997; Nichols and Wahlen, 2004). For stock i at time t, the daily abnormal return is defined by the difference between the stock's daily raw return and the equally weighted daily return of the size portfolio, the stock belongs to at the beginning of the year:[4]

$$AR_{i,t} = R_{i,t} - Size_t \tag{3}$$

where $R_{i,t}$ is stock i's daily return at time t and $Size_t$ is the equally weighted daily return for the corresponding size portfolio.

Cumulative abnormal returns are obtained by summing daily abnormal returns of stock i for various event windows following (and excluding) the announcement day:

$$CAR_i(q) = \sum_{t=1}^{q} AR_{i,t} \tag{4}$$

where q is the length (in trading days) of the period, over which abnormal returns are cumulated.

2.4. Statistical significance of abnormal returns

Evidence regarding anomalies and/or financial market efficiency is always subject to criticism about the statistical significance of dis-

4. The size of a company is calculated at the beginning of each year, by multiplying the share price by the number of shares outstanding. Each stock is then assigned to one of ten size-portfolios.

played results. The tests conducted within this study are not free of those statistical biases (no study actually is), but I aimed at limiting, as much as possible, their consequences. For most of the tests, a non-parametric significance test, initiated by Foster, Olsen, and Shevlin (1984), employed by Ikenberry, Lakonishok, and Vermaelen (1995), Ikenberry, Rankine, and Stice (1996) Lee (1997) and reviewed by Lyon, Barber, and Tsai (1999) is used. It relies on statistical significance levels, which are drawn from an empirical sample distribution.

Statistical significance is assessed by comparing the observed portfolio cumulated abnormal return (hereafter *CAR*) with the empirical distribution of *CAR*s for a companion sample. The empirical distribution is generated as follows:

1. For each event in the portfolio, randomly select one event in the parent population.
2. Compute equal weighted *CAR*s for the companion sample.
3. Repeat steps 1 and 2 2 500 times and rank the companion sample *CAR*s from the lowest to the highest to obtain the empirical distribution.

This test has several appealing properties. It does not assume normality; it does not assume constant variance of security returns over time and it does not assume cross-sectional independence in the residuals. Moreover, as Lyon, Barber, and Tsai (1999) point out, unlike the conventional t-statistic, in which the null hypothesis is that the mean *CAR* is zero, the null hypothesis by approximating the empirical distribution is that the mean *CAR* equals the companion mean *CAR*.

2.5. Descriptive statistics

Panel A of table 1 presents sample wide descriptive statistics for variables of interest. The mean standardized unexpected earnings (*SUE*) is –0.0103 and the median is zero, indicating a slight left skewness in the distribution. These figures confirm analysts' optimism in earnings forecasts: their estimates globally overshot the actual figures. The market value (*MV*) ranges from $500,000 to $409 billion, comparable to (although less extreme than) those reported in a recent study by Zhang (2006). The monthly consensus is made up of 7 individual estimates on average (*COV*), with a minimum of 2 and a maximum of

44. Finally, the degree of disagreement between analysts, measured by the standard deviation of the consensus (*DISP*) is characterized by a mean of 0.64% and a median of 0.07%, indicating a right skewed distribution.

Table 1. – *Descriptive Statistics.*

Panel A: Sample Wide Descriptive Statistics							
Measure	Mean	Std.Dev.	Min	Q1	Median	Q3	Max
SUE_c	–0.0103	0.076	–5.86	–0.018	0.000	0.010	1.60
MV	2,226	8,575	0.5	110	325	1,138	408,800
COV	7	6	2	3	5	10	44
DISP	0.64%	11.35%	0.00%	0.03%	0.07%	0.15%	1194%
Panel B: *SUE* for Different Time Period Subsamples							
SUE_c (1983-1987)	–0.0145	0.0928	–2.36	–0.020	–0.007	0.007	1.01
SUE_c (1988-1991)	–0.0142	0.0797	–2.55	–0.020	–0.005	0.006	1.60
SUE_c (1992-1995)	–0.0085	0.0610	–2.91	–0.017	0.000	0.010	0.80
SUE_c (1996-1999)	–0.0093	0.0799	–5.86	–0.015	0.000	0.010	0.77

The table above displays sample wide statistics for various variables. Standardized Unexpected Earnings (*SUE*) is the difference between the consensus estimate preceding the earnings announcement and the actual earnings per share, scaled by the consensus standard deviation. Firm Size (*MV*) is the market value (in millions of dollars) at the beginning of the year. Analyst coverage (*COV*) is the number individual estimates, the consensus is made of. Forecast dispersion (*DISP*) is the standard deviation of the consensus.

In order to detect any temporal changes in analysts' optimism[5], I computed *SUE* statistics for 4 time subsamples. Panel B of table 1 reveals that both the mean and the median *SUE* increased, shifting from respectively –0.0145 (–0.007) to –0.0085 (0.000) over the first three time subsamples covering the period 1983-1995. These figures confirm results obtained by Brown (2001) and Richarson, Teoh, and Wysocki (2004), who document a recent decrease in analysts' optimism. For the forth time period (1996-1999), probably in conjunction with the dot-com bubble, there is no further decrease in optimism, as

5. See Brown (1993) for a review of early empirical literature on optimism in earnings forecasts.

shown by a slightly lower mean value of –0.0093, not statistically different from –0.0085.

Sample wide statistics for Cumulated Abnormal Return (*CAR*) windows are displayed in table 2. The mean and skewness statistics show that, for all event windows, the distribution is slightly right skewed. K-S statistics calculated for each variable (and not reported for simplicity) show that normality could be rejected for all variables at the 0.1 percent level.

Table 2. – *Sample Wide Cumulated Abnormal Return Statistics.*

Measure	Mean	Standard deviation	Skewness	Kurtosis
CAR event window (1)	0.0015	0.0675	0.331	18.499
CAR event window (3)	0.0011	0.0793	0.321	14.921
CAR event window (10)	0.0033	0.1041	0.856	22.905
CAR event window (30)	0.0077	0.1514	0.451	11.307
CAR event window (60)	0.0115	0.2107	0.307	7.375

The table above displays sample wide statistics for cumulated abnormal returns for 79 289 quarterly earnings announcements. The number in parentheses indicates the period (in trading days) over which individual abnormal stock returns are cumulated, starting and excluding the day, the earnings announcement is made.

3. Representativeness as a potential source of overreaction: empirical results

Most studies examine abnormal returns conditionally on past performance and report long-term reversals in abnormal stock performance (De Bondt and Thaler, 1985; Chopra, Lakonishok, and Ritter, 1992). In such a framework, empirical evidence of long-term reversals of stock returns does not explain the phenomenon by a known psychological (cognitive) bias, be it representativeness or any other heuristic. At most, it could be considered consistent which such a bias.

The aim of this study is to link overreaction to standardized unexpected earnings (*SUE*), computed in a way that allows identifying *highly unexpected earnings*[6]. Latter might cause the apparition of representativeness in investors' minds, who will tend to extrapolate this recent *unexpected* information, leading to overreaction.

3.1. Market (under-) reaction to current earnings surprises

Following the widely used portfolio-study approach, initiated by Ball and Brown (1968), I formed 10 portfolios based on the current earnings surprise, denoted SUE_c. Portfolio 1 contains the events with the highest positive earnings surprise, portfolio 10 the highest negative earnings surprises. The abnormal return of a given portfolio is the equal weighted average abnormal return of the events contained in this portfolio. Cumulated abnormal return statistics were computed for different event windows, such as the first trading day after the earnings announcement (denoted $CAR(1)$), the first 10 and first 60 trading days after the announcement (respectively denoted $CAR(10)$ and $CAR(60)$). Results are displayed in table 3.

The test statistics indicate that the stock price adjusts, on average, in the direction of the recent earnings surprise. For portfolios, which exhibit negative surprises, that is, portfolios 6 to 10, *CAR*s for all event windows are negative. These abnormal returns are significantly different from zero and increasing in the average earnings surprise of the portfolio. For example, the bottom decile portfolio, which exhibits a negative SUE_c equal to –0.1310, yields a negative cumulated abnormal return of –1.66% for the day following the announcement date (event window A) and –1.05% over the first ten trading days. Portfolio 9, displaying a smaller negative surprise (–0.0334) also experiences a smaller market reaction: on average –1.28% on the first trading day and –1.18% over the first ten trading days. Conversely, positive surprise portfolios (portfolios 1 to 4) exhibit positive *CAR*s that increase with the average standardized earnings surprise of the portfolio.

The results also indicate the existence of a slow price adjustment to unexpected earnings. With a few exceptions, cumulated abnormal returns increase steadily up to 60 days after the earnings announcement. The strategy which consists in buying portfolio 1 and short-sel-

6. This measure is presented in section 2.2 above.

Table 3. – *Cumulated Abnormal Returns Following Earnings Surprises.*

Event Windows Portfolio	SUE_c	A CAR(1)	B CAR(10)	C CAR(60)
1	0.0588	2.33%****	2.77%****	4.31%****
2	0.0195	1.67%****	1.93%****	2.84%****
3	0.0103	0.86%****	0.79%****	1.52%****
4	0.0044	0.49%****	0.41%****	–0.14
5	0.0000	0.04%	–0.10	0.08
6	–0.0039	–0.06	–0.01	–0.62%***
7	–0.0098	–0.57%****	–0.54%****	–1.16%****
8	–0.0174	–0.87%****	–0.82%****	–1.84%****
9	–0.0334	–1.28%****	–1.18%****	–1.96%****
10	–0.1310	–1.66%****	–1.05%****	–1.93%****

The table shows cumulated abnormal returns (*CAR*) for different event windows, (the announcement data being day 0) for 10 portfolios, formed based on the recent standardized earnings surprise (SUE_c). Latter is defined as the difference between the earnings estimate from the month preceding the earnings announcement and the actual earnings per share value, scaled by the standard deviation of the estimate. The daily abnormal return a given stocks is defined as the daily raw return of that stock minus the equal weighted average return of the size portfolio, this stock belongs to at the beginning of the year.
The symbols *, **, ***, **** and ***** indicate that the measure is significantly different from zero at, respectively, the 10%, 5%, 1%, 0.5% and 0.1% level, assuming a two-tailed test.

ling portfolio 10 the day the announcement is made, yields an abnormal return of 3.82% over the first 10 trading days and 6.24% over the first 60 trading days following the earnings announcement.

These results are in line with those reported by previous studies; for example, Nichols and Wahlen (2004) obtain similar, although smaller results for the period 1988-2002. Over the 10 (60) first trading days, the authors report a difference of 2.1% (5.2%) in abnormal returns between the lowest and the highest unexpected earnings decile[7].

7. The *SUE* measure used in this study differs slightly from that retained by Nichols and Wahlen (2004). Latter standardize the unexpected earnings measure (*UE*) by the share price, while I divide by the consensus standard deviation. As a consequence, portfolios 1 and 10 may contain more events with highly unexpected earnings. This fact may explain the higher abnormal returns reported in this study.

3.2. Evidence of overreaction after past highly unexpected earnings

While the preliminary results tend to confirm existing evidence of underreaction to earnings announcements, the remaining part of this article provides evidence that besides short term stock price underreaction there is also a longer term overreaction to past unexpected earnings. I investigate whether the representativeness bias could potentially explain this overreaction phenomenon.

If representativeness affects investor behavior in the way hypnotized earlier (see section 1.3 for a discussion between naive extrapolation and contrarian strategies), I would find evidence for two distinct phenomena. First, events with highly unexpected earnings should lead to an overreaction phenomenon and, on average, at the time of the subsequent earnings announcement, a reversal. Second, according to the representativeness hypothesis, the degree of overreaction should be increasing in the extent to which the series of similar earnings surprises is long.

3.2.1. Market reaction conditionally on the past earnings surprise

Investors who are prone to representativeness extrapolate their information too far into the future. As, on average, these extreme expectations are not confirmed by actual figures, there should be later reversals. Especially after highly unexpected surprises, one could expect investors to overestimate future earnings surprises. On average, important surprises should be followed, at the date of subsequent earnings announcement, by a correction of the initial overreaction, that is, by *CAR*s of the opposite sign.

Using a classical portfolio approach, I assigned each of the events to one of 10 portfolios based on the preceding quarter standardized unexpected earnings (SUE_{c-1}). Portfolio 1 displays the highest *SUE* events, portfolio 10 the lowest *SUE* events. Results are presented in table 4.

The results displayed in panel A of table 4 are consistent with the overreaction / representativeness hypothesis. It seems that investors rely to heavily on the information carried by the past earnings surprise. After an important positive surprise ($SUE_{c-1} = 0.0548$ for portfolio 1) they are deceived, on average, by the recent earnings figures. For this portfolio, cumulated abnormal returns computed over the period

Table 4. – *Market Reaction Conditional on the Preceding Earnings Surprise.*

Panel A: Cumulated Abnormal Returns Conditional on SUE_{c-1}

Portfolio	SUE_{c-1}	A CAR(1)	B CAR(3)	C CAR(30)	D CAR(60)
1	0.0548	–0.66%$^{\diamond\diamond\diamond\diamond}$	–0.92%$^{\diamond\diamond\diamond\diamond}$	–1.21%$^{\diamond\diamond\diamond\diamond}$	–1.91%$^{\diamond\diamond\diamond\diamond}$
2	0.0181	–0.49%$^{\diamond\diamond\diamond\diamond}$	–0.64%$^{\diamond\diamond\diamond\diamond}$	–0.61%$^{\diamond\diamond\diamond\diamond}$	–0.74%$^{\diamond\diamond\diamond\diamond}$
3	0.0102	–0.06%$^{\diamond\diamond}$	–0.24%$^{\diamond\diamond\diamond\diamond}$	–0.23%$^{\diamond\diamond\diamond\diamond}$	–0.44%$^{\diamond\diamond\diamond\diamond}$
4	0.0042	–0.01%$^{\diamond}$	–0.15%$^{\diamond\diamond}$	–0.09%$^{\diamond\diamond\diamond\diamond}$	–0.14%$^{\diamond\diamond\diamond\diamond}$
5	0.0000	0.12%	–0.01%	0.57%	0.31%$^{\diamond\diamond\diamond}$
6	–0.0040	0.18%	0.11%	0.67%	0.53%$^{\diamond\diamond}$
7	–0.0098	0.46%****	0.54%****	1.27%**	1.32%
8	–0.0171	0.10%	0.22%	0.59%	0.65%
9	–0.0319	0.57%****	0.65%****	1.43%****	1.32%
10	–0.1214	0.66%****	0.78%****	1.35%***	1.32%

Panel B: Correlation Coefficients between lagged SUEs

	SUE_{c-1}	SUE_{c-2}	SUE_{c-3}	SUE_{c-4}
SUE_c	0.137%	0.071%	0.042%	0.058%

Panel A shows cumulated abnormal returns for 10 portfolios formed according to the preceding quarter standardized earnings surprise (SUE_{c-1}) for different event windows. Each window A, B, C et D displays, in braces, the number of trading days following the earnings announcement over which abnormal return are cumulated.
The symbols *, **, ***, and **** indicate that the measure is significantly higher than, respectively, 90%, 95%, 99%, and 99,5% of a sample-wide empirical distribution.
The symbols $^{\diamond}$, $^{\diamond\diamond}$, $^{\diamond\diamond\diamond}$, and $^{\diamond\diamond\diamond\diamond}$ indicate that the measure is significantly lower than, respectively, 90%, 95%, 99%, and 99,5% of a sample wide empirical distribution.

Panel B displays serial correlation statistics for quarterly lagged standardized unexpected earnings (SUE). All correlation coefficients are significantly different from zero at the 99% level.

following the recent earnings announcement are negative, yielding –0.66% the first trading day and even –1.91% over the 60 first trading days after the announcement.

For non null-surprise portfolios, computed *CAR*s are of the opposite sign to the preceding quarter earnings surprise, and generally significantly different from the mean value of a randomly generated sample wide empirical distribution. Thus, a positive (negative) surprise, generating an immediate and extreme positive (negative) market reaction, is, on average, followed by a reversal, that is, negative (positive) abnormal returns at the time of the subsequent earnings announcement.

While these results seem to confirm the first part of the overreaction/representativeness hypothesis, one cannot exclude the possibility that current abnormal returns occur as a pure rational response to *current* unexpected earnings. This would be the case if consecutive earnings surprises are negatively correlated: after a positive past surprise, there would be, on average, a negative current surprise, followed by negative abnormal returns. In this context, latter could by no means be interpreted as a reversal phenomenon. In order to examine whether the reported results in panel A of table 4 are potentially due to a negative autocorrelation in *SUE*s, I computed pairwise correlation statistics between the current quarter *SUE* and the preceding quarter *SUE*s. The results (displayed in panel B of table 4) show that, on average, standardized unexpected earnings are *positively* correlated. Thus, the abnormal return results displayed above may in fact be attributed to the reversal phenomenon that follows the investor overreaction after the preceding quarter earnings announcement.

3.2.2. Market reaction to current null surprises

The results reported above reveal that after a past quarterly announcement, characterized by highly unexpected earnings (captured by the *SUE* measure), stock prices tend to *revert* at the time of the subsequent earnings announcement. According to the underlying hypothesis of representativeness, investors overreact to the past quarter earnings information and make too extreme forecasts for the subsequent quarter, driving prices away from fundamental values.

Even if the results indicate a positive correlation between consecutive *SUE*s, one might argue that the reported reversal phenomenon might stem from the fact that the tests did not condition on the information revealed in the current quarter. Indeed, it cannot be excluded that portfolios 1 (extreme positive SUE_{c-1} values) and 10 (extreme negative SUE_{c-1} values) contain many events having a small current surprises of the same sign than SUE_{c-1} and a few events of extreme earnings surprises of the opposite sign. Former imply a small or no market reaction, while latter would be followed by large stock price changes, thus explaining both the positive correlation between lagged *SUE*s and the stock price reversal reported in table 4.

In order to eliminate such a possibility, I conducted an additional test, limited to those events that belong the current null surprise decile (portfolio 5), obtained before (table 3)[8]. For this portfolio, the mean standardized unexpected earnings (*SUE*) equals zero. Although some studies report small positive abnormal returns following earnings announcements (Bartov, Givoly, and Hayn, 2002) or a higher market valuation (Kasznik and McNichols, 2002) for firms meeting expectations, test statistics in table 3 indicate no significant cumulated abnormal returns[9]. If any subset of this sample, based on previous earnings surprises, exhibits significant *CAR*s, it can be assumed that they are induced by the previous earnings surprise rather than the current null surprise.

Table 5 displays cumulated abnormal return statistics for events of portfolio 5, sorted and ranked into 10 portfolios based on past earnings surprise SUE_{c-1}. As all events display, on average, a recent null surprise, there should be no significant market reaction to this recent announcement. However, extreme past surprise portfolios show a strong correction pattern: cumulated abnormal returns are globally negative for prior positive surprises. For example, top prior surprise decile ($SUE_{c-1} = 0.0412$) yields an abnormal return of –0.84% for the first trading day (event window A), –1.26% over the first three days (event window B) and even a –2.22% over the 60 trading days following the earnings announcement (event window D).

I find a similar pattern for past negative surprises. On average, important negative surprises are followed by positive *CAR*s over the days following the subsequent earnings announcement (event windows A and B). Despite a recent null surprise, cumulated abnormal return for portfolios 8 to 10 ranges from 0.62% to 0.72% for the first trading day

8. Due to inherent limitations of the I/B/E/S/ database (rounding limited to 2 decimals, followed by stock splits), zero forecasts errors are reported more frequently than actually occurred. Using a "broader" definition of null surprises helps avoiding this bias.

9. This divergence may stem from the fact that I did not focus exclusively on exact null surprises and use an alternative definition of *SUE*.

Table 5. – *Market Reaction Conditional on the Preceding Earnings Surprise for Recent Null Surprise Events.*

Portfolio	SUE_{c-1}	A CAR(1)	B CAR(3)	C CAR(30)	D CAR(60)
1	0.0412	–0.84%$^{\diamond\diamond\diamond\diamond}$	–1.26%$^{\diamond\diamond\diamond\diamond}$	–2.07%$^{\diamond\diamond\diamond\diamond}$	–2.22%$^{\diamond\diamond\diamond\diamond}$
2	0.0161	–1.68%$^{\diamond\diamond\diamond\diamond}$	–2.07%$^{\diamond\diamond\diamond\diamond}$	–2.24%$^{\diamond\diamond\diamond\diamond}$	–2.26%$^{\diamond\diamond}$
3	0.0100	0.20%	0.33%	–0.39%	–1.31%
4	0.0040	–0.23%	–0.65%$^{\diamond}$	–1.04%	–0.61%
5	0.0000	0.03%	–0.09%	0.16%	–0.07%
6	0.0000	–0.04%	–0.54%$^{\diamond\diamond}$	–0.70%	–0.95%
7	–0.0056	0.63%**	0.38%*	–0.39%	–1.35%
8	–0.0101	0.62%**	0.58%**	1.98%***	2.37%****
9	–0.0196	0.67%**	0.70%**	2.55%****	3.46%****
10	–0.0765	0.72%**	0.49%**	0.64%	–1.06%

The table displays cumulated abnormal returns (*CAR*) for 10 portfolios, that were formed based on past standardized unexpected earnings SUE_{c-1}. This portfolio constitution was restrained to events that exhibit a recent null surprise. *CAR* were computed for different event windows, denoted A, B, C, and D.

The symbols *, **, ***, and **** indicate that the measure is significantly higher than, respectively, 90%, 95%, 99%, and 99,5% of the empirical distribution generated from subsample portfolio 5.
The symbols $^{\diamond}$, $^{\diamond\diamond}$, $^{\diamond\diamond\diamond}$, and $^{\diamond\diamond\diamond\diamond}$ indicate that the measure is significantly lower than, respectively, 90%, 95%, 99%, and 99,5% of the empirical distribution generated from subsample portfolio 5.

and from 0.49% to 0.70% for the first three trading days. The results reveal an upward drift for portfolios 8 and 9, displaying respectively 1.98% (2.55%) for event window C and 2.37% (3.46%) for event window D. While portfolio 10 experiences cumulated abnormal returns that are consistent with the overreaction hypothesis over the first three trading days, longer event windows display non-significant abnormal returns. One possible explanation is that the extreme negative surprise experienced in the previous quarter was too large for the (supposed) overreaction to be corrected by only one null surprise.

Globally, the results indicate that events with prior highly unexpected earnings experience an important reversal at the time of a subsequent null-surprise. Consistent with the overreaction/representativeness hypothesis, investors extrapolate past surprises and formulate extreme forecasts. Even if actual earnings figures meet analyst estimates, they are less extreme than investors' beliefs and lead to a reversal phenomenon.

3.3. Evidence of increasing overreaction after a series of similar surprises

The idea that a representativeness bias leads investors to extrapolate recent earnings surprises implies that a series of similar earnings surprises increases the degree of overreaction. Put simply, investors are supposed to extrapolate more heavily a piece of information that is confirmed repeatedly than one that comes alone. The tests performed in this section focus on the effect of a series of past similar unexpected earnings, in the way defined before (*SUE* measure), on the market reaction at the time of the current earnings release.

For those studies, which focus on the reaction to a series of similar past surprises, I repeat the portfolio formation procedure, used in previous tests, backwards. The events of each portfolio, obtained at the first step, are, in a second step, ranked according to the earnings surprise of the preceding quarter and assigned to one of three portfolios (respectively positive, null and negative surprises). This procedure is repeated up to 4 times, yielding, at most, one current earnings surprise and 4 past surprises. This selection-rank methodology allows a progressive portfolio study, where consecutively formed portfolios only differ from their parent portfolio by the most ancient earnings surprise. This methodology allows focusing on the impact of the number of similar past earnings surprises on the market reaction to the most recent earnings announcement. Thereby it is possible to identify the marginal impact of an additional (past) similar surprise on the strength of representativeness/overreaction.

3.3.1. Market Reaction after a Series of Similar Past Earnings Surprises

The results presented above indicate that an extreme earnings surprise is followed, at the time of the subsequent earnings announcement, by a market reaction in the opposite direction to the initial surprise. These findings suggest the presence of investors' overreaction to earnings surprises. If this overreaction is due to representativeness, then investors would not only extrapolate an earnings surprise into the future, but also misreact more heavily to a *series* of similar surprises. Hence, I expect the reversal to be more pronounced for events with long series of good or bad earnings surprises.

Table 6 displays cumulated abnormal returns after extreme positive (portfolio 1) and extreme negative (portfolio 10) current earnings surprises, conditional on the number of similar earnings surprises, immediately preceding the current earnings announcement. The symbol "+" indicates a positive past earnings surprise, the symbol "–" a negative past earnings surprise.

The results are consistent with the overreaction/representativeness hypothesis. For events with current *positive* unexpected earnings and without conditioning on past surprises, the market reaction is positive with a return of 2.33% on the first trading day after the earnings announcement (window A), steadily increasing up to 4.31% for event window D, cumulating abnormal returns over the 60 days following the event date. When I select those event, which display one positive past earnings surprise (portfolio denoted 1,+), the market reaction is weaker for all event windows, with 1.98% for event window A, 2.52% for event window C and 2.76% for event window D. Increasing the number of previous similar (positive) surprises seems to weaken the market reaction, which decreases to 2.31% (portfolio 1,+,+), 0.32% (portfolio 1,+,+,+) and even –1.97% (portfolio 1,+,+,+,+) for window D.

For preceding negative surprises, denoted by the symbol –, the market reaction is stronger than for the overall portfolio 1, even if this pattern is the strongest for event windows B and C, displaying *CAR*s over respectively 3 and 30 trading days after the event date. Up to 3 past negative surprises, the market reaction increases steadily, with an abnormal return of 3.11% (4.33%) for one past negative surprise, 4.00% (5.33%) for two past negative surprises and 4.05% (5.61%) for three past negative earnings surprises for event window B (the figures in parentheses indicated *CAR*s for event window C). A notable exception is Portfolio 1,−,−,−,−, where abnormal returns do not confirm the pattern found for all other portfolios. One reason for these results may be the current surprise having occurred, as the SUE_c statistic is below that of all other portfolios and might explain the poor perform-

Table 6. – *Market Reaction after a Series of Similar Past Earnings Surprises.*

Portfolio	SUE*c*	Sample Size	A CAR(1)	B CAR(3)	C CAR(30)	D CAR(60)
1	0.0588	4684	2.33%	2.39%	3.51%	4.31%
1,+	0.0588	1085	1.98%$^{\diamond\diamond}$	1.91%$^{\diamond\diamond\diamond}$	2.52%$^{\diamond\diamond\diamond\diamond}$	2.76%$^{\diamond\diamond\diamond\diamond}$
1,+,+	0.0708	279	2.20%	1.90%$^{\diamond\diamond\diamond}$	1.55%$^{\diamond\diamond\diamond\diamond}$	2.31%$^{\diamond\diamond\diamond\diamond}$
1,+,+,+	0.0869	69	1.47%$^{\diamond\diamond\diamond}$	1.33%$^{\diamond\diamond\diamond\diamond}$	–0.94%$^{\diamond\diamond\diamond\diamond}$	0.32%$^{\diamond\diamond\diamond\diamond}$
1,+,+,+,+	0.1369	18	–0.53%$^{\diamond\diamond\diamond\diamond}$	0.01%$^{\diamond\diamond\diamond\diamond}$	–1.92%$^{\diamond\diamond\diamond\diamond}$	–1.97%$^{\diamond\diamond\diamond\diamond}$
1	0.0588	4684	2.33%	2.39%	3.51%	4.31%
1,–	0.0588	1122	2.59%*	3.11%***	4.33%****	4.94%**
1,–,–	0.0554	302	3.05%***	4.00%****	5.33%****	4.50%
1,–,–,–	0.0534	85	2.94%***	4.05%****	5.61%****	4.55%*
1,–,–,–,–	0.0479	23	2.21%	3.19%***	2.89%	3.15%
10	–0.1310	4781	–1.66%	–1.33%	–1.48%	–1.93%
10,+	–0.1269	1365	–1.62%	–1.47%$^{\diamond}$	–1.79%$^{\diamond\diamond}$	–1.99%
10,+,+	–0.1241	303	–1.23%	–1.67%$^{\diamond\diamond}$	–1.92%$^{\diamond\diamond\diamond}$	–2.16%$^{\diamond}$
10,+,+,+	–0.1420	75	–0.25%	–1.82%$^{\diamond\diamond\diamond}$	–2.77%$^{\diamond\diamond\diamond\diamond}$	–2.85%$^{\diamond\diamond\diamond}$
10,+,+,+,+	–0.1131	19	1.10%	–1.70%$^{\diamond\diamond}$	–5.45%$^{\diamond\diamond\diamond\diamond}$	–6.01%$^{\diamond\diamond\diamond\diamond}$
10	–0.1310	4781	–1.66%	–1.33%	–1.48%	–1.93%
10,–	–0.1419	1240	–1.41%*	–0.96%*	–0.75%***	–1.18%***
10,–,–	–0.1397	305	–0.80%***	–0.82%**	–0.33%****	–0.38%****
10,–,–,–	–0.1120	118	–0.21%****	–0.10%****	–2.50%	–1.86%
10,–,–,–,–	–0.1319	21	–2.12%	–1.29%	–2.30%	–3.05%

The table shows cumulated abnormal returns for various event windows. Portfolios are formed sequentially, starting from the current earnings announcement (portfolios 1 and 10 displaying, respectively, the highest and lowest standardized unexpected earnings), and then proceeding backwards, forming, at each step, 3 portfolios (high , mid and low surprise portfolios), based on the preceding standardized unexpected earnings. The number of + and - indicated the number of backward steps used in forming a given portfolio. For example, events in portfolio 10,+,+,+ belong to the decile having had the lowest *current* unexpected earnings and having experienced 3 large, consecutive, positive earnings surprises in the 3 preceding quarters.

Cumulated abnormal returns are computed for the first trading day after the announcement (event window A), the period covering the first three trading days (B), 30 trading days (C), and trading 60 days (D) following the earnings announcement.

The symbols *, **, ***, and **** indicate that the measure is significantly higher than, respectively, 90%, 95%, 99%, and 99,5% of the empirical distribution generated from the respective parent portfolio (1 or 10).
The symbols $^{\diamond}$, $^{\diamond\diamond}$, $^{\diamond\diamond\diamond}$, and $^{\diamond\diamond\diamond\diamond}$ indicate that the measure is significantly lower than, respectively, 90%, 95%, 99%, and 99,5% of the empirical distribution generated from the respective parent portfolio (1 or 10).

ance. Moreover, the sample size being extremely small (only 23 events), the test statistics may be influenced by extreme stock price changes unrelated to the information pattern, I focused on.

Similar results are obtained for events with extreme current negative earnings surprises. The overall market reaction for portfolio 10 is negative, consistent with the type of information released at the date of announcement. When I condition on past surprises, this (negative) reaction is increasingly stronger for events with preceding positive surprises for event windows B, C and D[10]. For the latter, the overall *CAR* statistic is –1.93% and decreases to –1.99% for one positive past surprise and 2.16%, –2.85% and –6.01% for, respectively one, two, three and four positive past surprises.

Finally, events with preceding positive earnings surprises (portfolios 10, +, ...) indicate a weaker market reaction to the current negative earnings information, at least in the first days after the event. *CAR* statistics for the first three trading day indicate respectively –0.96%, –0.82%, –0.10% for one, two and three consecutive positive past surprises, compared to an overall abnormal return of –1.33% without conditioning on past information. Similar results are obtained for other event windows, even if the reversal pattern is not fully verified for portfolios having experienced three and four negative past surprises. However, the results obtained for subsamples of the negative surprise portfolio 10 globally confirm the overreaction/representativeness hypothesis in the same way than those reported for portfolio 1. It seems that a series of past similar surprises causes an overreaction phenomenon, where the length of this series *weakens* the market reaction in case of a current surprise of the same sign (positive past surprises followed by a positive current surprise or negative past surprises followed by a negative current surprise) and strengthens the market reaction in case of a current surprise of the opposite sign (positive past followed by a negative current or negative past followed by a positive current surprise).

10. The first trading day after the announcement (window A) displays *opposite* return statistics, indicating a market reaction, which *weakens* with the number of preceding negative events. My understanding is that after a series of positive earnings announcements, investors hesitate to react immediately to the extreme negative current information. Over the following days, however, they integrate the degree to which the earnings surprise differs from those experienced in the preceding quarters.

Although not reported, complementary tests indicate that the differences in cumulated abnormal returns are neither due to a size effect, nor to differences in coverage between firms. While there is indeed a size effect between the extreme surprise deciles 1 and 10 (the average market value is respectively \$2,360 millions and \$1,370 millions) and a small but significant difference in coverage between these portfolios (the consensus is made of respectively 7.65 and 6.92 individual estimates on average), the design of the preceding tests imply comparisons *within* the current surprise deciles. In this context, no significant differences for market value or coverage can be found between subsamples of portfolio 1 or 10, outruling the possibility that the results are contaminated by size/coverage factors.

3.3.2. Market Reaction to a Current Null Surprise after a Series of Similar Past Earnings Surprises

Similarly to the test described in section 3.2.2, the study presented hereafter focuses on current null-surprise events (portfolio 5). I rank these events according to the most recent past standardized unexpected earnings (SUE_{c-1}) and form three equal sized portfolios (which could be understood as *positive*, *null*, and *negative* $c-1$ surprise portfolios). Each of those portfolios is divided again into three subportfolios, based on the earnings surprises, that lies two quarters behind (SUE_{c-2}). I repeat this procedure until I have 5 consecutive quarters (SUE_c until SUE_{c-4}). This procedure identifies events with a series of similar past earnings surprises, while keeping the most recent surprise SUE_c close to zero.

Results are reported in table 7. They are consistent with the representativeness hypothesis. In addition to a correction period consecutively to recent earnings announcement, it appears that this correction is stronger for a long series of similar consecutive earnings surprises. For example, portfolio denoted 5, 1, 1, 1, 1, having experienced a series of four positive past surprises and a current null surprise, displays a negative cumulated abnormal return of –3.07% for the first trading day, –4.73% over the first 30, and –11.18% over the first 60 trading days. This portfolio outperforms portfolio 5, 1, 1, 1, with only three consecutive positive past earnings surprises over nearly all event windows. Recall that those earnings announcements are actually *null surprises*, that is, the current earnings figures match, on average, analysts' esti-

Table 7. – *Market Reaction Conditionnal on Previous Earnings Surprises.*

Portfolio	SUE *c*	Sample Size	A (0;1)	B (0;3)	C (0;30)	D (0;60)
5,1,1,1,1	0.0026	18	–3.07%◊◊◊◊	–1.76%◊◊◊◊	–4.73%◊◊◊◊	–11.18%◊◊◊◊
5,1,1,1	0.0006	77	–1.59%◊◊◊◊	–3.12%◊◊◊◊	–1.21%◊◊◊◊	–4.40%◊◊◊◊
5,1,1	0.0005	271	–0.75%◊◊◊◊	–1.64%◊◊◊◊	–2.19%◊◊◊◊	–3.48%◊◊◊◊
5,1	0.0005	1103	–0.83%◊◊◊◊	–1.25%◊◊◊◊	–1.77%◊◊◊◊	–1.80%◊◊◊◊
5	–0.0001	4673	–0.02%	–0.23%	0.04%	–0.13%
5,3	–0.0006	1112	0.53%****	0.41%****	1.24%****	0.70%*
5,3,3	–0.0008	280	0.57%****	0.73%****	1.32%****	0.54%
5,3,3,3	–0.0008	80	1.78%****	1.41%****	2.13%****	–0.69%
5,3,3,3,3	–0.0021	21	1.65%****	1.53%****	2.63%****	3.25%****

The table shows that cumulated abnormal returns, computed for different event windows, are increasing in the length of a past earnings surprise series. All portfolios are formed sequentially starting from the current null surprise (portfolio 5), then forming, at each step, 3 portfolios based on the preceding standardized unexpected earnings.

Cumulated abnormal returns are computed for the first trading day after the announcement (event window A), the period covering the first three trading days (B), 30 trading days (C), and trading 60 days following the earnings announcement.

The symbols *, **, ***, and **** indicate that the measure is significantly higher than, respectively, 90%, 95%, 99%, and 99,5% of the empirical distribution generated from subsample portfolio 5. The symbols ◊, ◊◊, ◊◊◊, and ◊◊◊◊ indicate that the measure is significantly lower than, respectively, 90%, 95%, 99%, and 99,5% of the empirical distribution generated from subsample portfolio 5.

mates. Similar results are obtained for portfolios with prior negative surprises; thus displaying positive abnormal returns after the current null-surprise.

These results indicate that the longer the series of similar earnings surprises (Standardized Unexpected Earnings in our study), the stronger the subsequent correction. This evidence is consistent with the idea that representativeness causes investors to overreact more heavily to a series of similar information. If these beliefs are not confirmed by actual earnings figures, the stock price experiences a strong reversal. Latter is increasing in the length of the series of similar earnings surprises.

4. Conclusions

Psychological theory and experimental studies have established that investors make mistakes in forming their beliefs. Behavioral Finance argues that taking into account cognitive biases such as overconfidence, anchoring, or representativeness could provide a better understanding of empirical anomalies, such as under- or overreaction.

Performed studies indicate that anomalous stock price behavior around earnings announcements, which is consistent with overreaction, could be based on representativeness. I conjectured that a series of past similar surprises causes an overreaction phenomenon, which drives stock prices below their fundamental value after a series of negative surprises and above their fundamental value after a series of positive surprises. The tests reveal that at the time of a subsequent earnings release, and for a given earnings surprise, the market reaction increases when the stocks experienced negative past surprises and decreases in cases with positive past surprises, indicating at least a partial correction of the preceding overreaction. The increase or decrease of the market reaction is positively related to the number of similar past surprises, consistent with the idea that investors tend to extrapolate more heavily a series of similar information; one of the underpinnings of representativeness.

Focusing on null surprise events, the tests provide evidence that past, highly unexpected earnings are followed, at the time of the subsequent earnings announcement, by cumulated abnormal returns of the opposite sign to the initial reaction. These findings confirm that the stock market initially extrapolates the recent earnings surprise and overreacts to earnings surprises. Despite a non-informative earnings announcement, the stock prices experience a return reversal. Again, consistent with the representativeness hypothesis, series of similar surprises are more heavily extrapolated and lead to stronger subsequent reversals.

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