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Long-term overreaction in today's stock market

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This thesis tests the long-term overreaction for the contrarian investment strategy. Using a simple concept for estimating normal returns, shows the possibility for investors to obtain abnormal profits. However, using a more complex concept for stock return, no abnormal profits can be obtained and long-term overreaction is visible. Neither the January effect and the small firm effect explains the long-term overreaction.

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Introduction

Since the global outbreak of COVID-19, our society has been confronted with a variety of challenges, especially in the economy. Almost all countries struggle with direct economic problems, including a large number of layoffs and an increasing rate of bankruptcies. The economic markets were impacted heavily. For example the stock markets dropped very fast. This even resulted in several daily loss records. During this stock market crash, several investment strategies made abnormal returns. (Horn, 2020)

The strategies for abnormal returns are well-known for quite some time. One of the oldest investment strategy is the latter strategy: buying recent winners and selling recent losers. Other strategies derived from this are the contrarian investment strategy, value investing and post earnings announcement drift . The discovery of these investment strategies could theoretically lead to abnormal profits. However, when the investment strategy is published by scientists, investors will respond to it and the abnormal returns shall quickly decline to zero. Nevertheless, some investment strategies can still be valuable for investors, because these strategies are still able to generate abnormal returns.

The thesis will focus on the contrarian investment strategy. DeBondt and Thaler (1985) argue that this strategy is caused by long-term overreaction. The thrust of the strategy is as follows, track the stock market for a certain time period and list the best and worst performing stocks. Subsequently, you will invest in the stock market for the same time period by taking a long position in the worst performing stocks and a short position in the best performing stocks. This strategy should theoretically result in an abnormal return. These abnormal returns due to long-term overreaction are proven by DeBondt and Thaler (1985) and later on by Campbell and Limmack (1997). Over time and due to publicly availability of the investment strategy, the abnormal returns could be disappeared, because of the response of the investors. Himmelmann, Schiereck and Simpson (2012) for example did not find the abnormal return for the period after 1999 till 2004.

Other researches do not argue that the long-term overreaction is the cause for the abnormal return. When executing the contrarian investment strategy. Zarowin (1990)

argues that the abnormal return, observed by DeBondt and Thaler, is the result of the small-firm effect. Another cause for the abnormal return is time varying risk explained by Chan (1988). Rozef and Kenny (1976) also did not agree with DeBondt and Thaler and argue that the January effect is the explanation for the anomalous return. Conrad and Kaul (1993) did not agree and they came up with another interesting idea. They argue that the low price effect is the source for the abnormal return observed by DeBondt and Thaler.

The results of the long-term overreaction and some effects are remarkable The method of DeBondt and Thaler (1985) generated significant abnormal returns for American stock data from 2010 until 2019. Chan (1988) criticized this method and uses a different market model with time varying risk. In this paper, time varying risk is also applied, and it does not ensure abnormal return, so the long-term overreaction is not the cause. The January effect is also tested for the long-term overreaction and the conclusion is that this effect has no direct relationship with the long-term overreaction. At last, the small firm effect is tested and this ensures underreaction in the first year but in the long-term overreaction still exists.

In this thesis the contrarian investment strategy will be tested and the ability of the strategy to achieve abnormal returns. In addition, it is tested whether the long-term overreaction is the cause of the contrarian investment strategy or another reason. This results in the following research question:

Does the contrarian investment strategy still outperform the market due to long-term overreaction or is it caused by an accumulation of different effects?

The long-term overreaction is according to DeBondt and Thaler (1985) the cause for the abnormal return following the contrarian investment strategy. They found a wide array of empirical evidence and other researchers found evidence as well. On the other hand, as discussed in the previous paragraph, there are certain researches that do not believe that the long-term overreaction is the cause for the abnormal return. Besides all these pro and contra arguments for the long-term overreaction, there are some researches that did not find the abnormal return at all, following the application of the contrarian investment strategy. In recent years, the subject is studied less by researches.

Different opinions about the long-term overreaction and the possible existence of the abnormal return following the contrarian investment strategy show a scientific gap.

An additional up-side from researching the contrarian investment strategy is the possible abnormal profit for investor. If the strategy still generates abnormal returns, this offers a profit opportunity for all investment companies. For example, pension funds could implement this strategy, because the risk is not high in this case. Resulting in better pensions for the people that are members of these pension funds. Therefore, the total society can gain if there still exists abnormal return. Besides the financial advantages, this thesis will partly answer the question whether people act rational or not. If abnormal returns exist due to the long-term overreaction, investors do not act rational, as overreaction is the result of irrational behaviour.

This thesis is structured as follows, in section II, the previous literature will be reviewed in more detail about this subject. All the criticism will be explained as well. In section III, the data gathering process will elaborated upon. Section IV explains the methodology and the formulation of the hypotheses with their procedure. In section V the results of the hypotheses will be described including acceptance or rejection. Section VI is the conclusion of the research and the discussion.

Literature review

Asset pricing is useful for rational speculators, because they have to stabilize the asset prices. This idea goes back to Friedman (1953) who explained the whole stabilization of pricing. According to his idea, is the world split in two groups of investors. The first group of investors, also known as the irrationals, destabilize prices: buy when the prices are high and sell when they are low and eventually go bankrupt. The second group, called the rationals, invest in the opposite direction of the irrationals and they earn profits. The rationals trade against the investors who are less rational. The irrationals move the prices away from there fundamental value and the rationals will stabilize it. This line of reasoning is broadly accepted in papers on trading and market efficiency. Fama (1970) came up with the efficient market hypothesis (EMH), what the ideas of Friedman (1953) summarizes in a model. Kyle (1985) and also DeLong, Shleifer, Summers and Waldmann (1987) support the ideas of Friedman (1953) and Fama (1970)

Theoretically a sound idea but practice shows otherwise, a lot of empirical research is performed in the meantime and the theorem of stabilizing prices to their fundamental value is not always true. Jensen (1978) concludes that, there are some anomalies in the observed data. Besides that French (1980) explains some of the anomalies by the weekend effect. In the years thereafter there were a lot of researches who found a lot of theorems that declared al lot of these anomalies, like Lakonishok and Smidt (1988) who found the end-of-December effect. The existence of the anomalies tells us that an investor can generate abnormal returns. Plenty of different researches invented new investment strategies, that take advantage of the anomalies. Investors that could systematically beat the market and earn abnormal profits.

2.1 DeBondt and Thalers idea about the long-term overreaction

DeBondt and Thaler (1985) find such of an investment strategy. They found in empirical studies on individual choice behaviour enough evidence for overreaction of investors to new information in the market. This overreaction is a behavioural principle, because the overreaction is in line with the repressiveness heuristic. When DeBondt and Thaler (1985) discovered the empirical evidence and the behavioural principle, they tried to predict the overreaction in the market. They formulated two hypotheses, first of all the directional effect, the movements in stock prices are countered by a change in the prices

in the opposite direction. The second hypothesis is the magnitude effect, if the price movement is more extreme than the reaction will be greater. DeBondt and Thaler (1985) proved these two hypotheses with many empirical results.

The investment strategy of DeBondt and Thaler (1985) substantiated with empirical results goes as follows. The loser portfolios build in periods of three and five years perform significantly better in the next three and five years than the winner portfolios build in the same period, go long in the losers and short in the winners. The results of the three year portfolio is showed in figure 1. This figure shows that the losers strongly outperform the winners. Besides that, they found in their results that the size of the reversal is proportionate to the initial price shifts. An important footnote is that these differences in performance is not due to the compensation of risk. Additionally, DeBondt and Thaler (1985) observed stronger reversals for the loser portfolios than for the winners, an asymmetric overreaction. This asymmetric overreaction is mainly seen in January. These two arguments conclude that actual abnormal returns are able to be obtained. The weak form of the EMH must be rejected.

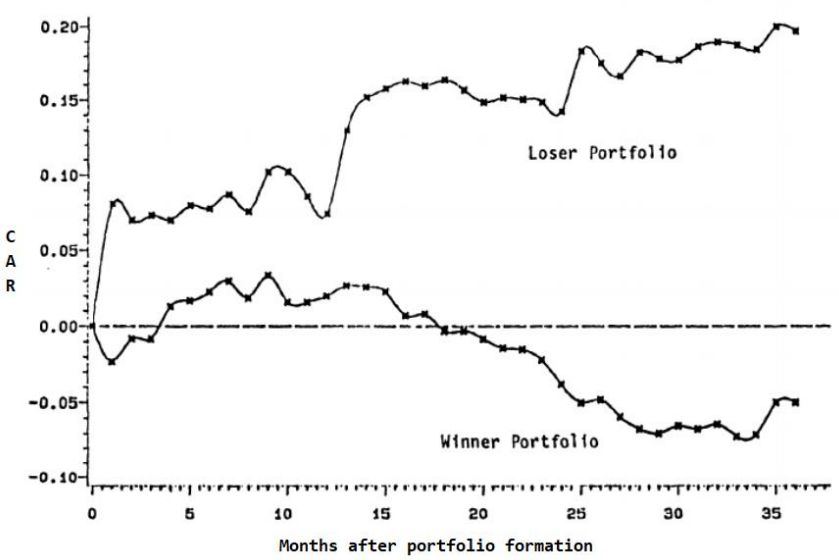

Figure 1 Cumulative abnormal residuals for the three year portfolio of DeBondt and Thaler (1985)

The work of DeBondt and Thaler (1985) is different than other researchers of their time, due to their use of a behavioural hypotheses. Other researchers worked from the idea of rational expectations on the stock exchanges and financial markets. They tried to explain the anomalies they observed based on rational ideas. DeBondt and Thaler (1985) declared the abnormal return because of the long-term overreaction and based it on the irrational behaviour. The overreaction of DeBondt and Thaler (1985) is based on a paper of Kahneman and Tverksy (1973). They conclude that individual reasoning processes are

not in line with the law of mathematical statistics. Therefore they claim that repressiveness heuristics are often economical and effective, but it also leads to systematically and predictable mistakes. Grether (1980) agreed with the way of reasoning of Kahneman and Tversky as he found empirical evidence as well for these heuristics. Besides that he added that people who made decisions put more weight to evidence than their own prior beliefs, but do not ignore their prior beliefs. So they will not act following mathematical statistics. These theories convinced DeBondt and Thaler (1985) that investors overreact in long-term due to representativeness heuristics.

2.2 Underreaction versus overreaction

The long-term overreaction is most commonly executed for 3 ,4 or 5 year portfolios, but in almost every paper a 1 and 2 year period has also been taken in account. Especially, the one year period is a controversial time cycle, due to price momentum, a theory first described by Fama and French (1996). This theory states that the best and worst performing stocks in the past 3 to 12 months will continue with high and low returns over the next 3 to 12 months. Instead of overreaction by the contrarian investment strategy, an underreaction occurs. This suggests that the market does not react efficient to a release of earnings-related information or development in the past.

The price momentum theory and the related underreaction for the past 12 months is in contrast with the overreaction of DeBondt and Thaler (1985). This contrary could be explained by Hong and Stein (1999). They investigated these two theories and conclude if information spreads gradually the prices will underreact, because investors will chase down the trends to make profit. However, if this information is available at once the stock market will overreact, because now the investors can only implement simple strategies for profit, which leads to overreaction. Both reactions are reasonable explanations.

2.3 Criticism on DeBondt and Thalers theory

The long-term overreaction of the DeBondt and Thaler (1985) is criticized by a lot of researchers. One of the well-known criticism is by Chan (1988), he believes that the betas in the model of DeBondt and Thaler (1985) are not correctly estimated. The betas in the formation period of the winner and loser portfolios are the same in the test period. Chan (1988) calculated the betas and abnormal returns for the years separately. This technique

showed no evidence for the abnormal returns based on the contrarian investment strategy. Therefore, he concludes that the excess returns investors get from the contrarian strategy is just a compensation for the risk they take. Jones (1993) did not agree with DeBondt and Thaler (1985) as well, but with a different reason than Chan (1988). He argued that the long-term overreaction observed by DeBondt and Thaler (1985) is dominated by the presence of it in the period from 1933 till 1944 and after this period there is no suggestion of the long-term overreaction.

The different betas as Chan (1988) described have an effect on the equity value because it will change the debt/equity ratio, which will lead to a change in return and risk. So if the stock price increases, the leverage will decrease and the risk will also decrease. This could explain the reversal of stock prices in line with the EMH, because there could be a correlation between the abnormal returns and the future required return which is negative. Ball and Kothari (1989) observed the problems of the estimated betas as well, because the time varying risk has an important influence on the model. They used the returns across time and securities (RATS) procedure invented by Ibbotson (1975). The beauty of this model, is the fact that the risk changes with time and not just between the test period and the period of creation, yet also within these periods. Ball and Kothari (1989) find no evidence for the long-term overreaction and the contrarian strategy is in line with the EMH. Chopra, Lakonishok and Ritter(1992) also uses the RATS procedure and they found in contradiction with Ball and Kothari(1989) abnormal returns with the contrarian investment strategy. Besides that Chopra, Lakonishok and Ritter(1992) find abnormal returns according to the procedure of Jones (1993), this is also a different result.

An important calendar anomaly that could explain overreaction is the January effect. The January effect is formulated by Rozeff and Kinney (1976): returns in January are higher than in other months of the year. This effect is the result of the selling pressure in the end of December as a result of rebalancing and window dressing at the end of the year. Pettengill and Jordan (1990) observed a strong January seasonal in the contrarian strategy. They even say that all the abnormal returns due to overreaction are restricted to January. Therefore, they conclude that the long-term overreaction is caused by the January effect.

Another criticism of the long-term overreaction is the small firm effect. Zarowin (1990) describes this effect as follows: losers are often smaller than winners, and they will generally outperform winners, this does not depend on the long-term overreaction. So the small firm effect is observable by portfolios of small stocks. It is a logical explanation that the abnormal return measured by DeBondt and Thaler(1985) originates from the small firm effect. Especially, the abnormal return measured in January could be derived from this. Zarowin (1990) find that the small firm effect declares all the abnormal returns in this dataset. Chopra, Lakonishok and Ritter(1992) find a limited influence of the small firm effect. They conclude that only the small investors overreact, because they did not find significant evidence for the biggest stocks, though for the small stocks there was significant evidence.

2.4 Evidence of long-term overreaction

DeBondt and Thaler (1985) conclude in their paper that the abnormal returns are significant for a three and five year period. They focussed their research on one, two, three and five year periods. Two years later DeBondt and Thaler (1987) examined a four year period and they found additional evidence of abnormal returns. Mun, Vasconcellos and Kish (1999) also investigated the contrarian investment strategy and found significant results for a one, two and three year periods. They did not investigate the fourth and fifth year periods. It is remarkable that they found a higher abnormal return in the first year than in the second and third year periods. Stock (1990) found as well evidence for a one, three, four and five year periods with the highest return in the periods of four and five year periods.

The long-term overreaction of the stock market is tested by a lot of researches in different countries and time frames via the contrarian investment strategy. First of all, DeBondt and Thaler (1985) found prove for contrarian investment strategy for the NYSE from 1926 till 1982 prove of the contrarian investment strategy. Kato (1990) also found abnormal returns if this strategy is followed for the Japanese market from 1974 till 1987. Besides that Dissanaike(1997) and Campbell and Limmack (1997) found evidence for the stock market in the United Kingdom. Stock (1990) confirmed the long-term overreaction for the German stock exchange for the period from1973 till 1989. Also in Brazil is the overreaction observed by Da Costa (1994).

Data

The data used in this paper is derived from Wharton research data services. The first data item consist the dataset of stock prices of the firms. The stock exchanges that have been used are the NYSE, NYSE MKT and the NASDAQ. The monthly stock prices are taken from the CRSP database of Wharton. The largest time cycle that has been examined is a five year period, in total 10 years of stock price data is used. In this case, the time period is from January 2010 till December 2019, because this is the most recent data available and the influence of the crisis of 2008 is negligible. Moreover, only a limited amount of recent researches have been performed to the contrarian investment strategy and the long-term overreaction. To test the contrarian investment strategy only monthly data is used, in line with the majority of the other papers on this subject. In addition to the monthly stock prices is the market value-weighted return index used for an indication of the market. The value-weighted return is used to adjust for cash dividend payments, which have been reinvested. This data is also gathered from CRSP.

Additionally is data collected to check for the impact of the different effects that could explain the long-term overreaction. The first item is the firm size, this is the market value of equity. The market value is computed by using the outstanding shares times the stock price at the ending of the formation period, in this case December 2014. Furthermore, the risk free rate for every year is used based on the annual treasury bill rates.

3.1 Descriptive statistics

In table 1, all the descriptive statistics of the variables that have been used in this research are displayed. The first thing that catches the attention is the large number of observations for the stock price variable. This is the result of the usage of three exchanges and ensures that a total of 3083 different stocks are analysed in a timeframe of 10 years. The maximum stock price is also huge, Berkshire Hathaway has a very high stock price. The company has never split the stock. Another remarkable value is the observation of the market value-weighted return and the risk free rate. This reason therefore is that the 61st month is the formation period, therefore after that month another 60 months are needed in the test period of the contrarian investment strategy.

Besides this the standard deviation of the firm size is large, there is a wide variety in firm size. The standard deviation for the market value-weighted return and the risk free rate however is much lower.

Table 1 Descriptive statistics of the variables

Variable	Obs.	Avg.	Std. Dev.	Min.	Max.
Stock price	373043	102,057	3857,183	0,246	339590
Firm size	3083	7230817	26495822	2939,97	6,43E+08
Market value weighted return (incl. dividends)	121	0,010	0,037	-0,090	0,114
Risk free rate	121	0,024	0,006	0,015	0,039

Research methodology

The research is divided in four parts with their own hypothesis, these are all related to each other but treated separately. This choice is made because it will give a clear and logical answer on the research question. The first hypothesis is: there is evidence of abnormal return due to long-term overreaction. In this research the focus will be on the changes of the abnormal returns if the contrarian investment strategy is executed. This kind of research design is also known as an event study. Where the control period is used to find a pattern on how stocks behave. The formation moment (t=0) is the month where the portfolios are constructed and the test period is used to examine if the contrarian strategy has a significant effect, this is displayed in figure 2. In the control period there will be different approaches used to get the right estimation of the stock price return.

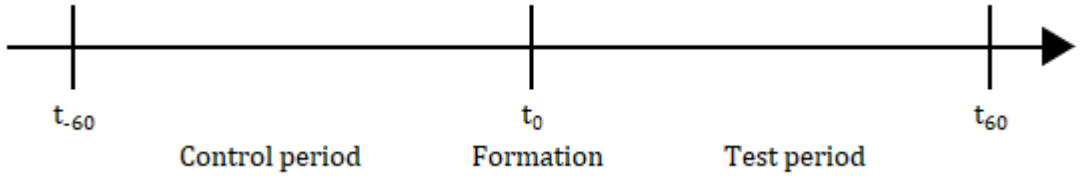

Figure 2 Timeline of the event study for a 5 year period

The portfolios are constructed as follows, the best performing 500 stock of a time cycle are put in a portfolio, the winners and the worst 500 stocks of a time cycle are put in a portfolio, the losers. The performance of a share is determined by taking the average return in the control period. In this paper, there are 5 different time cycles, the first is 1 year, the second 2 and so on till 5 years. These different time cycles are used as follows, the length of the time cycle indicates the control period and the test period. So for a 3 year period, the formation period will be 3 years and the test period will be 3 years. The formation period is for every time cycle the same month: December 2014 (t=0). For every different portfolio different time frames will be tested in the test period to check whether the long-term overreaction had taken place.

An event study is a common way of conducting research in finance. The event study that has been used in this paper is based on the differences in stock prices, which are actually the daily stock returns (R_t). To estimate these returns, the daily stock prices (P_t) are used and the stock prices of the day before (P_{t-1}) The daily stock returns are calculated as follows:

$$R_t = \frac{P_t - P_{t-1}}{P_{t-1}} \qquad (1)$$

For the prediction of the return in the test period, the market model is used. DeBondt and Thaler (1985) did use the market model as well. In the control period the α_i and the β_i are estimated to calculate the return. The market value-weighted return (R_{MIt}) including dividends is used in the following formula:

$$R_{it} = \alpha_i + \beta_i R_{MIt} \quad (2)$$

The estimation of α_i and β_i have been performed based on the Ordinary Least Squares (OLS). The estimations of $\widehat{\alpha_i}$and $\widehat{\beta_i}$are then used to predict the stock return for the test period. The predictions are called normal returns ($\widehat{R_{it}}$).

$$\widehat{R_{it}} = \widehat{\alpha_i} + \widehat{\beta_i} R_{MIt} \quad (3)$$

When the normal returns are estimated, the abnormal return (ar_{it}) of the stocks can subsequently be calculated. Therefore, the normal returns and the actual returns (R_{it}^*) are calculated as follows:

$$ar_{it} = R_{it}^* - \widehat{R_{it}} \quad (4)$$

If the abnormal return of the stocks is constructed the cumulative abnormal return ($CAR_{i,t}$) of the stocks, during the test period, is calculated. This is the sum of the average abnormal returns per portfolio(w) per month. The abnormal return of the first month will be added to the second one and so on. When all the CAR's are estimated the average cumulative abnormal return ($ACAR_{w,t}$) of the portfolio is calculated. The ACAR's of the portfolio's depends on the number (n) of stocks in a portfolio and will be formed by this formula:

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

For every ACAR the t-statistics and the standard errors will be calculated, to check whether the ACAR's are significantly different from zero. If this is the case and the winners have negative returns and the losers positive then the contrarian investment strategy is proven.

4.1 Time varying risk

The second hypothesis is as follows: time varying risks explain the long-term overreaction. If the RATS procedure of Ibbotson (1975) is applied to calculate the normal returns and no significant abnormal return is found, there is not enough evidence to accept the long-term overreaction. The RATS procedure is often executed by researchers to test if through time varying risk the EMH still holds, like Ball and Kothari (1989). The RATS procedure estimate the return of a stock with the capital asset pricing model

(CAPM) model invented by Jack Treynor (1961). The CAPM includes the risk free rate to have a more realistic picture of the normal return.

$$R_{it} - R_{ft} = \alpha_i + \beta_i(R_{MIt} - R_{ft}) \qquad (6)$$

The crux of the RATS procedure is the time varying risk, which results in different betas over time. It will generate a more precise estimation for the normal return. Every year a beta is estimated, instead of one beta for the whole time period like DeBondt and Thaler (1985) did. Not only different betas but also different alphas are estimated. The estimation of the normal return is also performed by OLS.

$$\widehat{R_{it}} - R_{ft} = \hat{\alpha}_i + \widehat{\beta_i}(R_{MIt} - R_{ft}) \qquad (7)$$

When the normal return is estimated via the RATS procedure the abnormal return will be calculated with formula (4). Subsequently the CAR's and eventually the ACAR's are determined by using formula (5) and the corresponding t-statistics. These formulas are used to examine whether the time varying risk explains the long-term overreaction.

4.2 January effect

The next hypothesis is: the January effect explains the long-term overreaction. This effect states that the abnormal returns in January ensure the abnormal return in the rest of the year. To check this, the ACAR's will be split. First, the ACAR's of January and then the ACAR's of the months February till December. Then one could observe if there are differences in return and in significance to accept or reject the hypothesis.

4.3 Small firm effect

The last hypothesis that will be tested is: the small firm effect explains the long-term overreaction. The size of firms would ensure that there is an abnormal return if the contrarian investment strategy is executed. To test this, the size of all the stocks are ranked from small to large. Then the stocks are divided in 5 equally sized groups, based on the firm size, so the smallest 20% are in group1 and the largest 20% are in group 5. For every portfolio the size rank will be calculated based on these 5 groups.

If there is a significance difference in size rank between the winner and loser portfolio, the CAR's and ACAR's will be recalculated without the impact of the size. To test without the effect of this impact, the third group has been used to calculate the CAR's and ACAR's. In the third group are all firms from approximately the same size. The winner and

loser portfolio will have instead of the 500 best or worst performing stocks the 100 best or worst stocks of the control period. If the portfolio's are made up the CAR's an ACAR's are determined, then one can conclude if the small firm effect describes the long-term overreaction.

Results

The first hypothesis based on the findings of DeBondt and Thaler (1985) is partly consistent with the long-term overreaction. Table 2 summarizes all the ACARs for the winner and loser portfolios. The sign of the winner portfolio is always negative just as DeBondt and Thalers (1985) expectation. But the loser portfolio is not always positive, for example -0,07 in the 5 year test period for the 5 year loser portfolio and it is significant. Besides that the winner portfolio is in absolute values higher than the loser portfolio, this means that the best stocks fail more than the worst succeed. This is an asymmetric overreaction like DeBondt and Thaler (1985) found, but they found it the other way around. The losers gained more than the winners failed. Additionally a lot of ACAR's are significant especially when the test period is enlengthened, there are more significant results.

Table 2 ACAR's of portfolio using the theory of DeBondt and Thaler (1985)

Type portfolio	ACAR's in test period				
	1 year	2 year	3 year	4 year	5 year
1 year winner	-0,002				
1 year loser	0,007				
2 year winner	-0,006*	-0,011			
2 year loser	0,000	0,005**			
3 year winner	-0,010*	-0,029	-0,040		
3 year loser	-0,002	0,007*	0,014*		
4 year winner	-0,006	-0,020*	-0,026**	-0,042**	
4 year loser	0,007*	0,014**	0,022*	0,021*	
5 year winner	-0,013	-0,029*	-0,041	-0,063*	-0,093**
5 year loser	0,001*	0,003	0,009**	0,005**	-0,007*

*Significant at 5% level
**Significant at 1% level

Another important result is the difference between the loser and the winner portfolio, so one can see if the contrarian investment strategy generates abnormal return. In table 3, the differences and their significance is displayed. These results are in line with DeBondt and Thaler (1985), because all returns are positive and the majority is significant. As earlier showed in table 2 the first year test period is again in the majority of the cases not significant. The first year test period also gives low ACAR's, this could be consequence of the price momentum. But looking to the other years, the ACAR's increase and are significant showing some interesting results.

Table 3 The ACAR's of the loser portfolio minus the winner portfolio

Type portfolio	Difference in ACAR's in test period				
	1 year	2 year	3 year	4 year	5 year
1 year cycle	0,009				
2 year cycle	0,006*	0,016			
3 year cycle	0,008	0,036**	0,054*		
4 year cycle	0,013*	0,034	0,048*	0,063**	
5 year cycle	0,015	0,033*	0,050	0,068**	0,086*

*Significant at 5% level
**Significant at 1% level

For a better understanding of the results, table 2 is visualised for the 4th year cycle in figure 3. This figure reconciles with the figures of DeBondt and Thaler (1985) where there is also an average upward sloping line for the loser portfolio and a downward sloping line for the winner portfolio. At the end of the period, both lines are downward sloping. An explanation is that the market value-weighted return increases for both portfolios and subsequently the CAR declined. Besides that, the deviation of the winner portfolio increases more at the end than the loser portfolio, almost at a zero CAR. Evidence for the long-term overreaction could off course be attributed to another effect or time varying risk, though the fact that the long-term overreaction still exists is a remarkable result.

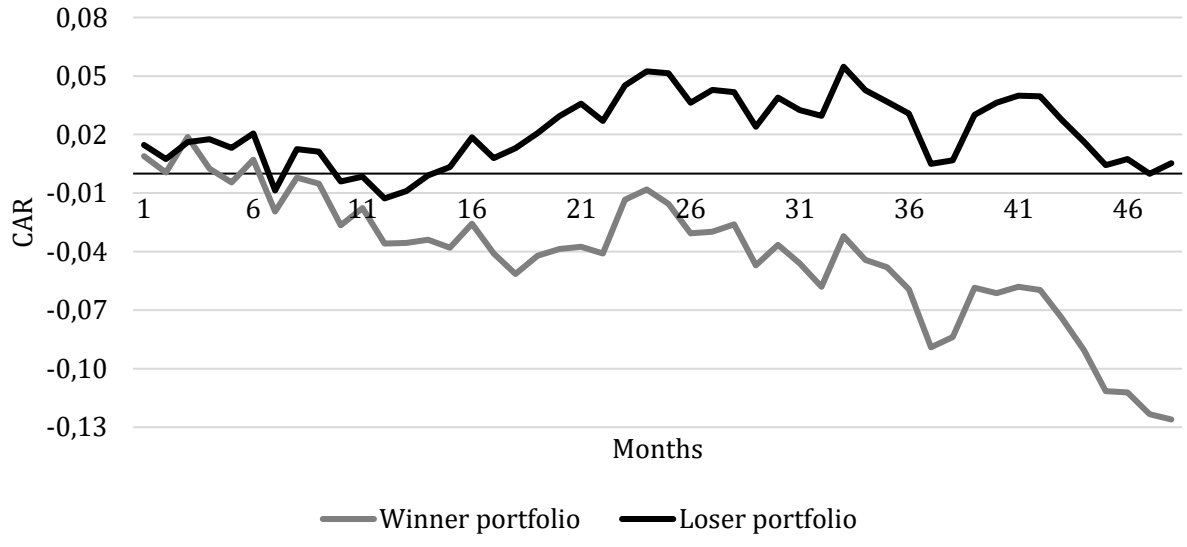

Figure 3 Cumulative abnormal return for the 4th time cycle

5.1 Time varying risk

For the second hypothesis, the CAPM model is used and the betas vary across time. The betas are estimated per year, equal to research of Ball and Kothari (1989) in their paper over the long-term overreaction. In figure 4 the different betas over time are plotted and it is obvious that the betas are not the same as DeBondt and Thaler (1985) assumed. The variety of betas will give a better view of the real return, except for the first time cycle because it had only one year test period. The betas of the winning portfolio are higher than the loser portfolios. This means that the return volatility of the winning stocks is higher than the losing ones. Ball and Kothari (1989) find the same difference between the betas of the winner and loser portfolio. The difference could be declared, because of the overreaction of the investors, causing higher volatility.

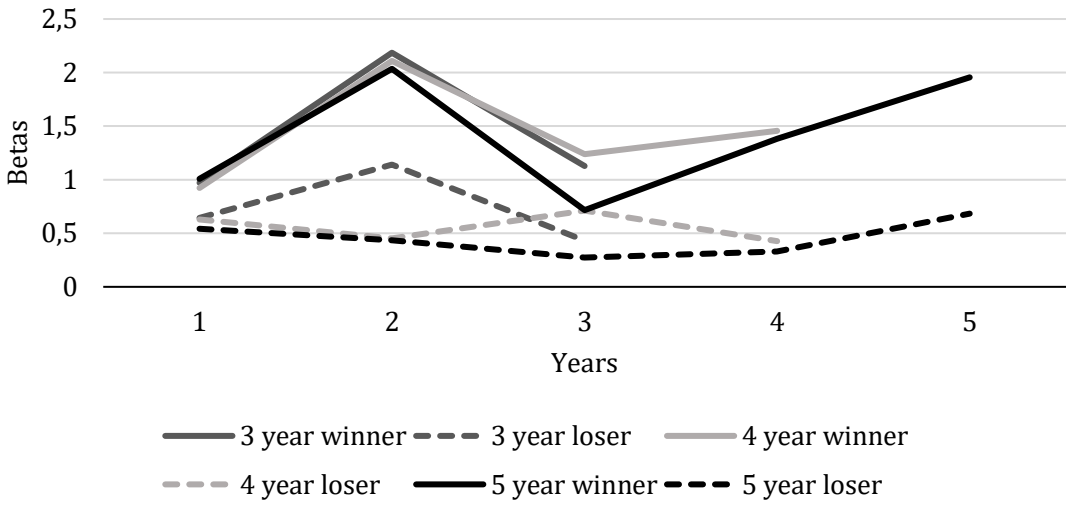

Figure 4 Betas of different portfolio relative to time in test period

When all the betas are known, the CAR's and the ACAR's are calculated. These results of the ACAR's are displayed in table 4. The differences between the winner and loser portfolios are also listed in table 4. The first remarkable item is the limited significant results. This means that the results can not be interpreted, although there can be some general sayings about the results. First, all the values for the ACAR's are positive, the winner portfolio do not lose and will generate positive abnormal returns. Besides that, the negative results of the differences in the ACAR. Every loser portfolio minus winner portfolio is negative. This is the opposite of what DeBondt and Thaler (1985) proclaim. The winners still outperform the losers, for the first year cycle, a reason could be that the price momentum occurs. The other negative signs are probably also caused by underreaction of the investors. Although all these items can not be interpreted, since these

are not significant. This does means that there is not enough evidence that the long-term overreaction appears using the time varying risk, like Ball and Kothari (1989) conclude.

Table 4 ACAR's and differences in ACAR's using CAPM and time varying risk

Type portfolio	ACAR's in test period				
	1 year	2 year	3 year	4 year	5 year
1 year winner	0,109*				
1 year loser	0,086				
1 year difference	*-0,023*				
2 year winner	0,105**	0,178			
2 year loser	0,099	0,176			
2 year difference	*-0,005*	*-0,002*			
3 year winner	0,119*	0,189	0,266		
3 year loser	0,096	0,168	0,220		
3 year difference	*-0,022*	*-0,021**	*-0,047*		
4 year winner	0,123	0,196	0,273	0,340	
4 year loser	0,089**	0,151	0,201	0,257	
4 year difference	*-0,034**	*-0,045*	*-0,072**	*-0,083*	
5 year winner	0,123	0,189	0,256	0,319*	0,373
5 year loser	0,087	0,156	0,221	0,291	0,361
5 year difference	*-0,036*	*-0,033*	*-0,035*	*-0,028*	*-0,012*

*Significant at 5% level
**Significant at 1% level

5.2 January effect

The next hypothesis is centred around the January effect. The market model used to test this hypothesis from DeBondt and Thaler (1985). These results are split up into January and the other months and will show if the January effect explains the long-term overreaction. Pettengill and Jordan (1990) used the same method. As shown in table 5, the January effect does not explain the long-term overreaction. The ACAR's of the month January are for the most year significant as well as for the other months. In January, the returns are not most of the times the highest, this means that January does not increase the ACAR's for the rest of the year which is remarkable. The rest of the months ACAR's are much closer to the ACAR's of all months than the January ACAR's, which means that the month January the overall ACAR's pulled down instead of raised up. This result is in line with Dissanaike (1997) who also concludes that the January effect does not explain the long-term overreaction. So there is enough evidence to reject this hypothesis.

Table 5 The ACAR's of the loser portfolio minus the winning portfolio split up in different time frames

Type portfolio	Test period	Differences in ACAR's		
		January	February-December	All months
1 year cylce	1 year	0,011*	0,008	0,009
2 year cycle	1 year	0,000	0,006	0,006*
3 year cycle	1 year	0,006	0,008*	0,008
4 year cycle	1 year	0,006*	0,014	0,013*
5 year cycle	1 year	0,004	0,016	0,015
2 year cycle	2 year	0,008	0,017**	0,016
3 year cycle	2 year	0,017*	0,037	0,036**
4 year cycle	2 year	0,016	0,035*	0,034
5 year cycle	2 year	0,014**	0,035	0,033*
3 year cycle	3 year	0,039*	0,055**	0,054*
4 year cycle	3 year	0,033*	0,050*	0,048*
4 year cycle	3 year	0,033	0,052*	0,050
4 year cycle	4 year	0,048*	0,064**	0,063**
5 year cycle	4 year	0,051*	0,070*	0,068**
5 year cycle	5 year	0,071**	0,087*	0,086*

*Significant at 5% level
**Significant at 1% level

5.3 Small firm effect

The last researched effect is the small firm effect, whether the size of a firm explains the long-term overreaction. The first thing tested, is the difference in size rank between the winner and the loser portfolios. As shown in table 6, there exists a significant difference between the portfolios. All the stocks of the third rank are selected to use as a new base to determine new winner and loser portfolios based on the 100 best and worst stocks. The difference in size rank has also been tested between the winner and loser portfolio, this difference is now not significant. Therefore, these portfolios are used to calculate the ACAR's and check whether the long-term overreaction is not a small firm effect.

In table 7 the ACAR's and the difference between the losers and the winners are displayed. This table differs from table 2 and 3, were the portfolios are build on all the stocks. Almost every value is significant and the ACAR's give several interesting observations. First of all, there are negative values for the losers, especially in the first and second year and positive values for the winners in the first year. This ensures that the differences in the first year are all negative and the majority are significant, one can say that the price momentum occurs in the first year, due to underreaction of the investors.

Besides that for the 4 and 5 year period there is a significant positive difference between losers and winners. In conclusion of this, there is still a long-term overreaction like DeBondt and Thaler (1985) argued. So there is not enough evidence to accept the hypothesis, the long-term overreaction is not explainable by the small firm effect.

Table 6 Size rank of all the portfolios for all the stocks and for group 3, with the corresponding p-values for the difference between winner and loser size rank

Type portfolio	Size rank			
	All stocks		Group 3	
	Winner	Loser	Winner	Loser
1 year cycle	3,3	2,4	3,2	2,8
2 year cycle	3,0	2,2	3,1	3,1
3 year cycle	3,0	2,2	3,0	3,0
4 year cycle	3,1	2,2	3,1	3,2
5 year cycle	3,1	2,1	3,0	3,2
p-value difference	0,000		0,328	
(t-statistic)	(21,14)		(2,45)	

Table 7 ACAR's and differences in ACAR's for the portfolios of group 3

Type portfolio	ACAR's in test period				
	1 year	2 year	3 year	4 year	5 year
1 year winner	0,023				
1 year loser	-0,011*				
1 year difference	*-0,034**				
2 year winner	0,006**	-0,017			
2 year loser	-0,032	-0,042*			
2 year difference	*-0,039***	*-0,025*			
3 year winner	0,007*	-0,018	-0,038*		
3 year loser	-0,041	-0,064*	-0,076**		
3 year difference	*-0,048*	*-0,046*	*-0,038**		
4 year winner	-0,016*	-0,040	-0,054*	-0,090*	
4 year loser	-0,019*	-0,012	0,004	0,006	
4 year difference	*-0,003**	*0,028*	*0,058**	*0,096**	
5 year winner	0,011	-0,001	-0,006**	-0,025	-0,052*
5 year loser	-0,006	0,015**	0,048*	0,074*	0,084
5 year difference	*-0,018***	*0,015*	*0,053**	*0,099**	*0,136***

*Significant at 5% level

**Significant at 1% level

Conclusion and discussion

This paper researches the theory of DeBondt and Thaler (1985) were they conclude that the long-term overreaction conducts abnormal returns if the contrarian investment strategy is executed. The data of the American stock exchanges is used from January 2010 till December 2019. If the same method of DeBondt and Thaler (1985) is used, it shows significant proof that the long-term overreaction still results in abnormal returns. This is only for the 3, 4 and 5 year periods the other 2 periods are not significant, though they have positive values. It make sense that the first year is not significant because of the price momentum phenom, where not overreaction, but underreaction occurs as Fama and French (1996) discovered.

A lot of researchers have criticized the work of DeBondt and Thaler (1985). One of the most well-known is the approach of normal return. Ball and Kothari (1989) claim for different betas and another market model, in this case the CAPM model. The betas are estimated per year instead of once. If this model is executed on the selected data the sign of the difference between losers and winners is always negative and almost all ACAR's are insignificant. So the long-term overreaction is not the cause for the abnormal returns. Besides the different model, some researchers like Rozeff and Kinney (1976) claim that the January effect causes the abnormal returns for the total period. This has been checked as well, but the results shows that this is not the case in the selected data.

Another school of thought is the small firm size effect were Zarowin (1990) proves that the long-term overreaction does not cause abnormal returns. The middle group of the size is used to estimate the ACAR's of a new winner and loser portfolio. These ACAR's show remarkable results, because in the first year the sign of the difference between the portfolio changes and not for the other years. Moreover almost all values are significant for the first year, which was not the case before. This could be the cause of underreaction. In the 4 and 5 year periods the results are significant and positive which indicates an overreaction. The small size effect does not explain the long-term overreaction.

In conclusion to answer the research question: Does the contrarian investment strategy still outperform the market due to long-term overreaction or is it an accumulation of different effects? If the method of DeBondt and Thaler (1985) is applied

abnormal returns are found. However, if a better model is used, CAPM, the EMH still holds and there is no long-term overreaction of the investors. In addition to this, the January effect and the small firm do not explain the abnormal returns

This thesis has its limits, first the sample size only compromise the American stock market and no worldwide dataset or specific other regions. Besides this there are some other theories that question the long-term overreaction. This is not tested in this paper because of the limitation of data that is available for every firm. Another limitation is the calculation of the normal return, here is chosen for the CAPM and varying betas. Some other researchers used the 3 or 5 factor model of Fama and French (1993,2015). These models will give an even better view of the reality. For these models are certain specific datasets needed, which were not available due to the constraints of the corona crisis.

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