LISBON
SCHOOL OF
ECONOMICS &
MANAGEMENT
UNIVERSIDADE DE LISBOA

MASTER
FINANCE

MASTER´S FINAL WORK
DISSERTATION

HERDING BEHAVIOUR IN THE PORTUGUESE STOCK MARKET

FILIPA CHARNECO DA COSTA MORA CAROLINO

OCTOBER - 2018

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SUPERVISION:
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ABSTRACT

Herding is the instinct of animals to follow the herd. It is also present in humans since the prehistory and converges by modelling behaviours and beliefs of the larger group within which they are secure. Humans tend to follow the other's decisions in order to be comfortable and not to fail alone.

In this dissertation, the presence of herding behaviour in the Portuguese Stock Market was studied. Initially, it was built up on the work of Chiang and Zheng (2010), which is an improvement of the model of Chang et.al (2000). The presence of the herding behaviour appears when a negative and statistically significant relation between the squared market return and the cross section absolute deviation is verified. The results show that herding behaviour is present in Portuguese Stock Market.

Also, it was investigated whether the herding behaviour is stronger during the down or up periods in the market. Finally, it was studied if stress movements influenced the herding behaviour. The results show that herding behaviour is stronger during down periods and during crisis period. During periods of uncertainty, people prefer to stay safe and comfortable following the decisions of others.

Keywords: Herding Behaviour, Cross-Section Absolute Deviations, PSI 20, Portuguese Stock Market.

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ABBREVIATIONS

CAPM - Capital assets pricing model

CSAD - Cross-sectional absolute deviation

CSSD - Cross-sectional standard deviation

EMH - Efficient market hypotheses

OLS - Ordinary least squares (estimator)

PSI 20 – Portugal stock index

1 INTRODUCTION

Herding behaviour is a recognised psychological concept which is used to explain the scenario in which investors, rationally or irrationally, mimic the decision of the others (Raafat, Chater & Frith, 2009). As Christie and Huang (1995), investors ignore their own beliefs, analysis and probably existent information to follow the others, even if they do not agree with it. The reason why humans follow this behaviour can be reduced to one word, "convenience". Since the pre-historical era people prefer to be part of a group, even if that means to fail, instead of failing and being alone; so, if there is a probability to fail even when people think that the group decision may not be the best, herding behaviour people prefer to change the decision if the other people prefer another option. (Asch, 1956).

To that end, the main goal of this dissertation is to investigate if herding behaviour exists in the Portuguese stock market. To the best of my knowledge there is no previous work that focus on the Portuguese market. The dissertation will contribute to advance to the knowledge of investment behaviour, as it will bring new insights about the behaviour of Portuguese investors, particularly in terms of herding behaviour.

Herding and imitation in economic and financial decisions could be considered as a social learning process that will balanced by emotions and socio-psychological traits determining receptivity to social influence (Baddeley, 2010)

As such, building on the work of Chiang and Zheng (2010), we will analyse data from January 1998 to December 2017 for firms on the PSI 20 index. It is important to investigate if herding behaviour is stronger during periods where the market is rising, or when the market is down. According to Christ and Huang (1995), herding behaviour is more likely to appear during periods of crises. As Portugal was subject to a severe crisis (Correia, 2016), it is interesting to analyse if it had any effect in the behaviour of the investors.

This dissertation is divided into 7 chapters. Chapter 2 contains the literature review containing the definition of herding behaviour and the previous studies which have already been carried out. Chapter 3 presents the model derivation. Chapter 4 consist of hypothesis

and methodology. Chapter 5 shows the data used in the research. Chapter 6 present the important results we have achieved. Finally, chapter 7 presents the conclusions and the limitations found on this study as well as some suggestions for future investigation. This dissertation fills in a gap and contributes by adding to the literature, that seeks empirical evidence, on the herding behaviour phenomena. The main objective is to know how investors react in accordance with the herding behaviour on the Portuguese stock market.

2 LITERATURE REVIEW

Herding is the instinct of animals to follow the herd. It is also present in humans since the prehistory and converge by modelling behaviours and beliefs of the larger group within which they are secure. (Raafat, Chater & Frith, 2009). Humans tend to look for others' beliefs and preferences to help them find their own perspectives. Thus, people need to observe the main decision of others in order to make sure that their own decision could be a good one. (Raafat, Chater & Frith, 2009). But how can that be seen in the financial markets? First, we will define the concept and then we will establish the connection to the stock market.

2.1 Definition of Herding Behaviour

Herding can be viewed as the arrangement of individuals' behaviours in a group (herd) through local interactions rather than centralized coordinate (Raafat, Chater & Frith, 2009). The difference of herding behaviour's transmission between automatic contagion and rational deliberation was performed by Raafat et al. (2009). In other words, we are talking about rational or irrational herding. The cognitive neuroscience can reveal the mechanisms underlying the transmission of information, which can help to elucidate patterns of herd behaviour. Herding is a social tendency that can incorporate beliefs about the herd. (Raafat, Chater & Frith, 2009)

A good example of herding behaviour on the everyday life could be fashion, where people specifically follow the style that is more "in" during a specific season.

In the present study, we will focus on herding behaviour in finance, generally characterized by mimicking the action of other investors to achieve in a market consensus (Bikhchandani & Sharma, 2001).

To better understand the herding concept in the real life, there is an example explained by Kleinberg and Easley (2010): a group of friends had decided to visit a city near their hometown where they had never been before. Before going, they read some guidebooks and googled what could be the best restaurant to have a good dinner. Based on this information, friends decided to go to the Restaurant X. When they arrived, they saw that there was another Restaurant Y near the Restaurant X that had many people eating while Restaurant X had only a few. If you believe that other diners have tastes similar to yours, and that they too have some information about where to eat, it may be rational to join the crowd at Y rather than to follow your own information. To see how this is possible, suppose that each diner has obtained independent but imperfect information about which of the two restaurants is better. Then, if there are already many diners in restaurant Y, the information that you can infer from their choices may be more powerful than your own private information, in which case it would in fact make sense for you to join them regardless of your own private information. Therefore, they changed the previous decision and went to the Restaurant Y (Kleinberg & Easley, 2010).

In this case, the group of friends chose imitation, ignored their research and followed the behaviour of the majority. Thus, the friends do not think about the determinants that may lead others to choose that restaurant or if that information was reliable. Individuals naturally try to reach a consensus to be safe. But the search for consensus can lead to reconsidering the validity of our own opinions.

In general, when the individual choices are based on the observation of the action of the majority we are facing herding behaviour or information cascade. Kleinberg and Easley (2010, p. 484) argue that "an information cascade has the potential to occur when people make decisions sequentially, with later people watching the actions of earlier people, and from these actions inferring something about what the earlier people know."

In the restaurant example, when the first people arrived, they chose Restaurant Y, transmitting information to later diners about what they knew. A cascade gains shape when people ignore their own information to follow earlier peoples' actions. The problem is that, they are drawing rational inferences from limited information because the reason why the first one chooses something was unknown.

In an additional approach of the example, the group decided to go to the Restaurant Y because friends' beliefs indicate that could be the best, at the same time, it is the most crowded. The information that had been gathered indicates that a decision was made based on a solution that is also shared by the majority. In this case, the decision is individual and not intentional to imitate the decision, so we cannot talk about intentional herding but spurious herding.

*2.*2 Types of Herding

There are several types of herding such as intentional vs. spurious herding (Bikhchandani & Sharma, 2000) and irrational vs. rational (Devenow & Welch, 1996). On one hand, intentional herding is when someone has the intention to mimic the action of other individuals because they think that there is a probability that they have private information or because they are not sure about the information. As such, they prefer to follow the others because if they fail they will be together. On the other hand, spurious herding happens when groups confronted with similar problems and information take similar decisions. (Bikhchandani & Sharma, 2000). In such situation, the herding behaviour is not a consequence of following the decision of others but a reaction in the same way when faced with the same problems. Spurious herding usually leads to efficient decision making while intentional herding does not necessarily.

Irrational herding occurs when investors incur in blind decisions, dismissing their own decision. Investors feel secure when they mimic the action of the crowd even if they need to ignore their previous research. According to General Theory of John Keynes (2018, p.138) "it is better for reputation to fail conventionally than to succeed unconventionally". Investors have more tendency to herd during situations when the

market is stressed (Christie & Huang, 1995) because humans prefer certainty and conformity. This approach is in line with Devenow and Welch (1996), which show that investors feel secure when following the crowd, even if they need to disregard their previous beliefs.

Finally, rational herding has intentional actions, usually resulting from information cascades and information learning. When the public access is not easy, people need to find other ways to arrive through the best option, so following the crowd seems to be the best one. Investors observe the actions of the others and, form assumptions, about the private assessment of information by others. Based on that, people take investment decisions in a rational and intentional form, following the decisions of the others.

To the end, Loa and Singh (2010) conclude that herding behaviour is conducive to market inefficiency when noise traders are included in this herding group. Traders take irrational and irregular investment decisions, which leads to sharp movements on price and in consequence hard values of volatility.

2.3 Categories of Herding

There are two ways in which herding behaviour can be measured. The first one is when herding is considered by a tendency to an average of a group of investors, that buy and sell simultaneously, specific securities.

The second category is more focused on herding in general like an aggregate behaviour of all the participants. The present study will be focused on the latter one, building on the work of Christie and Huang (1995), Chang et al. (2000) and Chiang and Zheng (2010). These studies were built and supported by the assumptions of the Capital Assets Pricing Model (CAPM). Accordingly, herd behaviour enables the investors to align their rational beliefs in favour to the decision of the majority in the market, and thus, stock returns tend towards market return. As such, according to CAPM, the dispersion of the return is linearly related to the market return, so when herding behaviour is not

present, we would expect a positive relation between the returns' dispersion and the market return.

On the other hand, Christie and Huang (1995) propose that when herding behaviour occurs the return dispersion of individual securities goes down, so the rational asset pricing models predict that the dispersion will increase with the absolute value of the market return. Still, the security returns will not deviate too far from the overall market return when we are in the presence of herd behaviour market. So, this will lead to an increase in dispersion at a decreasing rate, and if the herding is severe, it may lead to a decrease in dispersion.

Chang et al. (2000) challenged these findings. According to the authors, Christie and Huang (1995) method was very strict because was based on a powerful degree of non-linearity to achieve better results of herding behaviour. The Cross-Sectional Absolute Deviation (CSAD) is the average of the aggregate difference between the expected return of individual securities and market return. Chang et al. (2000) consider that, according to the rational CAPM, the relationship between market return and CSAD is positive. Accordingly, the authors defend that the rational asset pricing models predict that the relation is linear and not only that equity return dispersions are an increasing function of the market return. If market participants tend to follow the behaviour of the market and ignore their own priors during periods of large average price movements, then the linear and increasing relation between dispersion and market return will no longer hold. Instead, the relation can become non-linearly increasing or even decreasing. Nonetheless, Chiang and Zheng (2010) argue that this relationship should be negative and non-linear when herding behaviour occurs. The reason is that the absolute market return value increases, while the CSAD decreases, or increase at a decreasing rate.

2.4 Previous Empirical Evidence

According to the Efficient Market Hypothesis (EMH) the firm can make investment decisions with the assumption that security prices at any time reflect all available information (Ackert & Deaves, 2011). An individual that wishes to buy and sell

assume that the securities they are buying are worth more than the price that they are paying, while the securities that they are selling are worth less than the selling price. If the prices always reflect all information, the cost of information acquisition would be zero. However, this never happens in real market transactions. So, under EMH, it is reasonable to assume that prices reflect all information such that the marginal benefit of acting on the information does not exceed the marginal cost of acquiring the information. In other words, no investor can consistently generate excess returns.

As such, herding behaviour is not in line with EMH because investors reject the previous process and base their own information in the crowd's actions. Traders are buying and selling the stocks that other traders want to buy and sell instead of, buying, because the security is worth more than the price that they are willing to pay, and selling, because the securities' valuation is less than the price for which they are willing to sell.

Given that, informed and rational investors do not follow the action of the crowd. So, herding behaviour leads to a market inefficient situation that sometimes leads to speculative bubbles.

This may explain the fact that gathering information is: costly, transparent, requires weak regulation and acquisition of reporting. (Chang et.al 2000; Lao & Singh, 2010). Thus, Chang et.al (2000) and Lao and Singh (2010) find evidence that herding behaviour is more likely to occur on emerging markets. An emerging market is a market that have some characteristics of a development market but falls on some standard points. In emerging markets, not only the information is costlier but also, there is less transparency, weak regulation and acquisition of reporting. In a related line of research, Bickhchandani and Sharma (2001) point that herding behaviour is easier to find on stocks with small market capitalization, probably because there are less information available and market consensus.

Many factors influence the herding behaviour in stock markets like the return, the volume, the volatility and the financial crisis (Hsu, 2015). The influence that these factors could have in the herding behaviour could be different, depending of the market on which we are present. According to Lao and Sing (2010), herding behaviour is more likely to be

seen during rising periods in the Chinese Stock Market and falling periods in Indian stock markets, so the herding behaviour also depends of the movement of the market in specific situations. In consonance with this finding, Demirer et.al (2010) find that the presence of herding behaviour is stronger to occur over extreme movement periods in the market as market stress. This could be explained due the fact that less experienced investors blindly follow the media. Additionally, Chiang and Zheng (2010) find evidence of herding behaviour in periods of financial crisis because there is a human tendency to follow others in order to be comfortable and safe.

Therefore, it is possible to differentiate two categories of measure on the herding behaviour. The first one is when it is considered that herding tends to an average of a group of investors that buy and sell simultaneously specific securities. The second category is more focused on herding, in general, like an aggregate behaviour of all the participants, this study will be focused on the latter one. The strongest studies that are in the origin of this category were developed by Christie and Huang (1995), Chang et al. (2000) and Chiang and Zheng (2010). The latter two were built and supported by the scientific basis of Capital Assets Pricing Model (CAPM), and through herd behaviour, the investors align their rational beliefs in favour to the decision of the majority in the market, and thus, stock returns tend towards market return. According to CAPM, the dispersion of the return is linearly related to the market return, so when herding behaviour is not present we would expect a positive relation between the returns' dispersion and the market return.

Past research has tried to verify the existence or absence of herding behaviour in stock markets on different countries. For example, past studies focus on the Italian market (Caparrelli & Arcangelis, 2004), in the Chinese market (Demirer & Kutan, 2006) or in a set of European countries (Bernard, 2013). To the best of my knowledge, no previous studies have focused on the Portuguese stock market. To that end, the present study fills in a gap and contributes by adding to the literature, that seeks empirical evidence, on the herding behavior phenomena.

3 MODEL DERIVATION

Both models, Christie and Huang (1995) and Chang et al. (2000), analyse herding in terms of cross-sectional data on stock returns, implying that herd behaviour would lead security returns not to deviate far from the overall market returns.

Christie and Huang (1995), which suggest a method that measures investors herding towards the market consensus. The authors propose that during periods of extreme market movements investors are most likely to hide their own beliefs and follow the crowd. During normal periods, rational asset-pricing models predict that the dispersion in cross-sectional returns will increase with the absolute value of the market returns, since individual investors are trading based on their own private information, which is diverse. However, during periods of extreme market movements, individuals tend to suppress their own private information, and their investment decisions are more likely to mimic collective actions in the market. Individual stock returns, under these conditions, tend to cluster around the overall market return. In this way, the herding will be easier to find during periods of market stress, which is defined as the occurrence of extreme returns in a market portfolio.

Christie and Huang (1995) propose the cross-sectional standard deviation (CSSD) method, in order to measure the return dispersion, which will be shown below:

$$(1)\ CSSD_t = \sqrt{\frac{\sum_{i=1}^{N}(R_{i,t} - R_{m,t})^2}{(N-1)}}$$

Where N is the number of firms in the portfolio, $R_{i,t}$ is the observed return of stock i at time t, and $R_{m,t}$ is the cross-sectional average return of the sample (the cross-sectional average return of N stocks of the sample of time t).

Christie and Huang (1995) suggest that individuals are most likely to suppress their own beliefs in favour of the market consensus during periods of extreme market movements. According to Christie and Huang (1995), who studied the fluctuations in the immoderate values of the market rates to reveal dispersion degree, which is usually located at the end of the return distribution curves' edge. So, with the following

expression, the objective of Christie and Huang (1995) was to verify if dispersion degree differs with statistical significance from the mean of dispersion in order to test the herd behaviour:

$$(2)\ CSSD_t = \alpha + \beta_1 {D_t}^U + \beta_2 {D_t}^L + \varepsilon_t$$

Where $CSSD_t$ is the Cross Sectional Standard Deviation for t^{th} period and expresses the dispersion. D_t^U is the dummy variable which takes the number 1 if the market return on day t lies in the extreme upper tail of the return distribution and zero otherwise. D_t^L is the dummy variable which takes the number 1 if the market return on day t lies in the extreme lower tail of the return distribution and zero otherwise. So, this model specific analyse the extreme market movements, given that, the values of the upper tail of the distribution are the values which belong to the extreme positive movements and the values in the lower tail of the distribution being part of the extreme negative movements. β_s are the coefficient to be estimated.

There was a huge problem with this model, $CSSD_t$ is calculated by squared return-deviations so it tends to be sensitive to outliers.

In order to overcome that, Chang et al. (2000) propose the cross-sectional absolute deviation, a new approach using CAPM model, in order to resolve this sensitivity, which is measured by:

$$(3)\ CSAD_t = \frac{1}{N}\sum_{i=1}^{N}\left|R_{i,t} - R_{m,t}\right|$$

According to this innovation, the model that Chang et al. (2000) use is:

$$(4)\ CSAD_t = \gamma_0 + \gamma_1\left|R_{m,t}\right| + \gamma_2 {R_{m,t}}^2 + \varepsilon_t$$

The objective of Chang et al. (2000, p.1655) was to "demonstrate that rational asset pricing models predict not only that equity returns dispersion are an increasing function of market return but also that the relation was linear".

In standard asset pricing models, like the CAPM, it is assumed that returns' dispersion is linearly related to market return, so when there is no presence of herding behaviour it would be expected a positive value of coefficient γ_1.

However, when herding is present during times of extreme market movements, the cross-sectional dispersion of stock returns is expected to decrease or increase considerably less than proportional with market return, as linear asset pricing models would indicate. This dispersion measure quantities the average proximity of individual returns to the realized average. This behaviour is likely to increase the correlation among asset returns, and the corresponding dispersion among returns will decrease or at least increase at a less-than-proportional rate with the market return. Along with these lines, to capture this nonlinear relationship, the squared market return is introduced as an additional term and the analysis will be in a negative estimate of the coefficient γ_2.

Finally, Chiang and Zheng (2010) improved the model that of Chang et.al (2000). The model to detect the herding behaviour is the following:

$$(5)\ CSAD_t = \gamma_0 + \gamma_1 R_{m,t} + \gamma_2 \left|R_{m,t}\right| + \gamma_3 {R_{m,t}}^2 + \varepsilon_t$$

The difference is the addition of the term $R_{m,t}$ on the right part of the equation, that allows us to be concerned with the asymmetric investor behaviour under different market conditions. So, with this model it is possible to verify the asymmetry of the market return with the analysis of γ_1, the intensity of the market return related to the cross sectional absolute deviation with the estimation of coefficient γ_2 and finally, the presence of herding behaviour with the analysis of the relation between squared market return and the cross sectional absolute deviation represented by γ_3.

Also, since herd behaviour usually appears significantly during the high market's movement, the existence of the behaviour was selected via the linear relationship between Cross-Sectional Absolute Deviation (CSAD) and the mean of market portfolio cross-sectional return, and this is applied by adding the variable R_m^2.

Chiang and Zheng (2010) showed that $\gamma_2 + \gamma_1$ captures the relation between return dispersion and market return when $R_{m,t} > 0$ and $\gamma_2 - \gamma_1$ demonstrates the relation between return dispersion and market return when $R_{m,t} \leq 0$.

4 HYPOTHESES AND METHODOLOGY

In order to test, if herding behaviour is present in Portuguese stock market, we will propose another subtest to go a little bit further. In line with the previous studies, the adopted measurement of herding in this research will be based on the dispersion model by Chiang and Zheng (2010). The first hypothesis derived is:

Hypothesis 1: *In the presence of herding behaviour the relation between the cross section absolute deviation and the average of the market return is negative. (H0:* $\gamma_3 < 0$ *).*

In addition, it is important to understand where it is more likely to find the herding behaviour, in the up market (where the return is positive) or in the down market (where the return is negative). In order to, achieve those results we need to adapt the model to the following, as in Chiang and Zheng (2010):

$$(6)\ CSAD_t = \gamma_0 + \gamma_1(1-D)R_{m,t} + \gamma_2 D R_{m,t} + \gamma_3(1-D){R_{m,t}}^2 + \gamma_4 D {R_{m,t}}^2 + \varepsilon_t$$

This model does not include the variable $|R_{m,t}|$ because in this hypothesis the objective is to verify the influence of positive and negative returns in the herding behaviour and this variable transforms all the returns in positive values which means that it is not needed.

Where we split the data into two groups with a dummy variable D, which takes the value 1 when the stock return is negative and zero otherwise. As such, the derived hypothesis is:

Hypothesis 2: *If the effects of herding behaviour are establishing, herding behaviour is higher in the down market than in the up market. (H0:* $\gamma_4 - \gamma_3 < 0$ *).*

Finally, to test the evidence of herding behaviour in periods of market instability or crises, we will use another dummy variable to verify the influence of crises in the investors' behaviour following the next model:

$$(7)\ CSAD_t = \gamma_0 + \gamma_1 R_{m,t} + \gamma_2 |R_{m,t}| + \gamma_3 {R_{m,t}}^2 + \gamma_4 C R_{m,t} + \gamma_5 C |R_{m,t}| + \gamma_6 C {R_{m,t}}^2 + \varepsilon_t$$

Where C is a dummy variable, that equals to one the period corresponds to financial crisis and zero otherwise.

5 DATA

The data used in this study cover the period between January 1998 and December 2017 for the PSI 20 index and its components. The Portuguese Stock Index (PSI 20) was used as a proxy of the value-weighted return of the market portfolio ($R_{m,t}$), while the components' returns represent the individual stock returns ($R_{i,t}$). The choice of the PSI 20 index is supported by the fact that it is the most representative stock exchange in Portugal. This index reflects the prices evolution of the 20 biggest and most liquid companies amongst the ones that were negotiated in the market, and released in real time. The main objectives of the PSI 20 index was for it to be an indicator of the evolution of the Portuguese stock market and to be a sport of the exchange of futures and stocks. We started to choose only the companies of the actual PSI 20. Additionally, in order to have a more reliable sample, same other 7 companies were added to the sample, because at the moment PSI 20 have only 18 companies. The criteria to choose the additional companies was based on the fact that the characteristics of the companies are similar that the PSI 20 and because the companies already belonged to the PSI 20, some moment during the period of this study.

The prices of each stock and the index were obtained from Bloomberg Platform, and used to the daily returns as in the following formula, used by Ramadan (2015):

$$(8)\ R_{t=} \log\left(\frac{P_t - P_{t-1}}{P_{t-1}}\right)$$

6 RESULTS

Table I presents the descriptive statistics for the sample. It shows the market capitalization (Mkt Cap), the number of employees (No Employees), the shares outstanding (Shrs Out), the revenue (Revenue) and the earnings per share (EPS) of each firm.

Table I shows that the average market capitalization is of 5,146.98 millions of euros, ranging from 17.20 to 69,385.50 millions of euros, In terms of employees, the mean is of 19,268.72 employees, ranging from 641.00 to 200,961.00 employees, showing a very large dispersion, According to the Shares Outstanding, the mean is of 1,816.74 millions, between a minimum value of 25.60 and a maximum value of 16,136.20 millions, Related to the Revenue, the average is of 4,937.09 ranging from 71,01 to 48,390.00 millions of euros, Finally, in the EPS variable, the mean is of 0,30 ranging from -089 to 2.21.

Table I. Descriptive statistics

	Mkt Cap M€)[a]	No, Employees	Shrs Out (M€) [a]	Revenue (M€) [a]	EPS
Altri	1,556.90	705.00	205.10	665.78	0.47
Corticeira Amorim	1,351.30	4,342.00	133.00	701.61	0.57
CTT	483.00	12,135.00	150.00	693.67	0.27
BCP	3,536.70	13,167.00	15,114.00	2,200.00	0.01
EDP	11,404.70	11,566.00	3,656.50	15,750.00	0.23
EDP Renováveis	6,961.00	1,326.00	872.30	1,860.00	0.26
Ramada	246.20	641.00	25.60	156.89	2.21
Galp Energia	12,907.30	6,389.00	829.30	14580.00	0.73
Ibersol	316.80	9,207.00	36.00	443.27	0.95
Jeronimo Martins	7,126.70	104,203.00	629.30	16,280.00	0.61
Mota Engil	457.00	29,860.00	237.50	2,600.00	0.01

Navigator	3,013.50	3,210.00	717.50	1,640.00	0.31
NOS	2,619.60	2,494.00	515.20	1,560.00	0.24
Pharol	134.50	12,729.00	896.50	N,a	-0.89
REN	1,589.20	676.00	667.20	748.37	0.22
Semape	1,388.10	6,011.00	81.30	2160.00	0.57
Sonae	1,620.00	40,803.00	2,000.00	5710.00	0.08
Sonae Capital	177.80	1,353.00	250.00	182.33	-0.01
Banco BPI	2,127.10	4,896.00	1,456.90	624.90	0.26
Banco Santander	69,385.50	200,961.00	16,136.20	48,390.00	N,a
Nova Base	75.00	2,044.00	31.40	139.56	0.15
Teixeira Duarte	75.80	10,238.00	420.00	1040.00	-0.10
Cofina	69.50	768.00	102.60	91.06	0.07
Glintt	17.20	909.00	87.00	71.01	0.01
Impresa	34.20	1,085.00	168.00	201.82	-0.13
Mean	5,146.98	19,268.72	1,816.74	4,937.09	0.30
Standard deviation	13,833.75	43,527.79	4,233.28	10,516.04	0.54
Max	69,385.50	200,961.00	16,136.20	48,390.00	2.21
Min	17.20	641.00	25.60	71.01	-0.89

[(a)] M€ (millions of euros)

Table II presents the results of the OLS estimation of equation (5). R_m^2 (γ_3) is negative and statically significant at 1%. Thus, we not reject hypothesis 1 and find evidence that there is herding behaviour in Portuguese stock market, as expected. This means that the Portuguese Stock Market's, during the study´s period, investors were following the market performance with no interest in stock's properties in term of risk and return.

Table II. Estimation of the simple model

Model	Coefficients
Constant	0.010***
	(0.000)
R_m	0.038***
	(0.000)
$\lvert R_m \rvert$	0.362***
	(0.000)
R_m^2 (γ_3)	-0.724**
	(0.010)
Observations	5078
R-squared	0.279

P-value in parentheses
*p <0.1.
** p < 0.05.
*** p < 0.01.

The value of the observations is based on the fact that the data is daily returns and daily cross sectional absolute deviation for the 9 years between January 1998 and December 2017. It is important to refer that the analyses was performed only with the open days in the market.

Table III shows the results from the OLS estimation of equation (6). It allows us to examine the possibility of asymmetric effect of herding behaviour. According to Table 3, both coefficients, related to up and down (γ_3 and γ_4, respectively), are negative and statically significant but the coefficient related to the dummy variable multiple the squared return is only statistically significant at 10%. So, we find modest evidence that is quite consistent with the results presented earlier.

Table III. Estimation of herding behaviour being asymmetric

Model	Coefficients
Constant	0.100***
	(0.000)
(1-D) *R_m	0.402***
	(0.000)
D*R_m	-0.322***
	(0.000)
(1-D) *$R_m^2(\gamma_3)$	-0.668**
	(0.038)
D*R_m^2 (γ_4)	-0.787*
	(0.063)
Observations	5078
R-squared	0.279

P- value in parentheses
* p <0.1.
** p < 0.05.
*** p < 0.01.

It was already verified that herding behaviour is present in the down and in the up markets so we can go further in the estimation of the Hypothesis 2 $(H0: \gamma_4 - \gamma_3 < 0)$. To preform that, it was necessary to derivate the equation (6) in order to have the two coefficients together.

$$CSAD_t = \gamma_0 + \gamma_1(1-D)R_{m,t} + \gamma_2 DR_{m,t} + \gamma_3(1-D){R_{m,t}}^2 + \gamma_4 D{R_{m,t}}^2 + \varepsilon_t$$

$$CSAD_t = \gamma_0 + \gamma_1(1-D)R_{m,t} + \gamma_2 DR_{m,t} + \gamma_3 {R_{m,t}}^2 - \gamma_3 D{R_{m,t}}^2 + \gamma_4 D{R_{m,t}}^2 + \varepsilon_t$$

$$(9)\ CSAD_t = \gamma_0 + \gamma_1(1-D)R_{m,t} + \gamma_2 DR_{m,t} + \gamma_3 {R_{m,t}}^2 + (\gamma_4 - \gamma_3) D{R_{m,t}}^2 + \varepsilon_t$$

Table IV. Comparison of herding behaviour between up and down periods

Model	Coefficients
Constant	0.100***
	(0.000)
(1-D)*R_m	0.400***
	(0.000)
D*R_m	-0.324***
	(0.000)
R_m^2	-0.695***
	(0.001)
DR_m^2 $(\gamma_4 - \gamma_3)$	-0.137**
	(0.010)
Observations	5078
R-squared	0.279

P- value in parentheses
*p <0.1.
** p < 0.05.
*** p < 0.01.

According to Table IV, we verify that the coefficient $\gamma_4 - \gamma_3$ is negative and statistically significant. So, we validate hypothesis 2 and assume that herding behaviour is strongest on the down Portuguese market, which means that during periods of market rising and market falling investors prefer to follow the crowd instead of taking them own decisions. Nevertheless, investors choose more herding behaviour during falling periods (where market returns are negative) comparing to periods where the market is rising.

Finally, Table V presents the results of the regression for the influence of an extreme market movement in order to discuss the influence of the crisis in the degree of herding, by the significance analysis of the dummy variable (C). This dummy variable takes the value 1 when in a period of crises (between January 2010 and December 2014) and zero otherwise.

Table V. Estimation of the influence of crisis period on herding behaviour

Model	Coefficients
Constant	0.100***
	(0.000)
R_m	0.070***
	(0.000)
$\|R_m\|$	0.308***
	(0.000)
R_m^2	0.647
	(0.202)
$C*R_m$	-0.025**
	(0.024)
$C*\|R_m\|$	0.090***
	(0.000)
CR_m^2 (γ_6)	-1.938***
	(0.000)
Observations	5078
R-squared	0.283

P- value in parentheses
*p <0.1.
** p < 0.05.
*** p < 0.01.

The coefficient that we want to estimate is γ_6, because is the coefficient where the dummy variable is influencing the indicator of herding behaviour R_m^2.

According to Table V, we conclude that, as we expected, the stress periods influence and evidence the herding behaviour. It is possible to achieve that because the coefficient of Rm^2 with the influence of the dummy variable (γ_6) is negative and statistically significant at 1 %. This mean that, during stress periods people follow the other decisions in order to, be comfortable and safe.

7 CONCLUSION

7.1 Conclusions from Results

The main purpose of this study is to understand the existence of herding behaviour in the Portuguese stock market. To perform that, data of the PSI 20 was used, for the period of January 1998 to December 2017 and the Cross Section Absolute Deviation (CSAD) from Chiang and Zheng (2010).

According to previous studies, there was a stronger evidence of herding behaviour in emerging markets (Chang et.al, 2000 and Lao and Singh, 2010) and during rising periods. Additionally, there was an evidence of herding behaviour during financial crises period.

The findings in this study, suggest that herding behaviour is present in the Portuguese Stock Market as we find a negative and statistically significant coefficient for the Squared Market Return, which is the indicator of herding behaviour Also, a model was used to test if herding behaviour is more pronounced during up or down markets. The results show that herding behaviour is strongest on the down instead of the up market, which goes against what had been proposed by Lao and Sing (2010).

Finally, a model with a dummy variable was used, in order to study the influence of extreme movements (as crisis periods), in the herding behaviour. During the crises period, Portugal lived a difficult period which influenced many people, the industry sector and, in general, all the economy. “Portugal faced an unusually tough economic challenge: low growth, low productivity growth, high unemployment, large fiscal and current account deficits.” (Blanchard, 2007, p.20). As in previous studies (Chiang & Zheng, 2010), in this study, herding behaviour is more evident during stress periods, uncertainty is stronger, and people prefer to follow the beliefs of others in order to be comfortable and safe.

With this pioneer dissertation in the Portuguese Stock Market, it is possible to conclude that the Portuguese Stock Market has an evidence of herding behaviour, mainly during rising periods and financial crisis periods. These findings are of major importance

to have a better understanding of the Portuguese Stock Market's investors and accurately predict the movements of the market, in order to invest with more rational information. So, during falling and crisis periods, it is possible to assume that the market could be more vulnerable, because if there is a stronger evidence of herding behaviour, the efficiency of the market decreases.

7.2 Limitations and Future Research

Taking into account that the Portuguese stock market cannot survive closed to the other stock markets, it could be interesting to analyse if the cross-sectional standard deviation and the daily market return, both in United States of America, could be statistically significant in the CSAD model of Portugal.

Additionally, it could be interesting to perform an investigation of the influence of trading stock volume on herding behaviour, to know if it is more likely to see herding behaviour with a high or a low volume of trading.

Finally, another hypothesis is to analyse the difference of herding behaviour in financial and non-financial companies, because there are many extra factors that have an impact in the decision of trading or not.

REFERENCES

Ackert, Lucy F.; Deaves, R. Social Forces: Selfishness or Altruism? *Behavioral finance: Psychology, Decision-Making, and Markets* (Chap.2, 19 – 36) USA: South-Western Cengage Learning, 2011.

Asch, *Solomon. E. (1956)* Studies of independence and conformity: A minority of one against a unanimous majority. *Psychol.Monographs 70, 1-70*

Baddeley, M. (2010). Herding, social influence and economic decision-making: socio-psychological and neuroscientific analyses. *Philosophical Transactions of the Royal Society* (December 2009), 281-290.

Bernard, O. (2013). Herding Behaviour under Markets Condition: Empirical Evidence on the European Financial Markets, *International Journal of Economics and Financial Issues*, 3(1), 214–228.

Bikhchandani, S., & Sharma, S. (2001). Herding Behavior in Financial Markets, *IMF Staff Papers*, 47(3), 279-310.

Blanchard, O. (2007). Adjustment within the euro; the difficult case of Portugal. *Portuguese Economic Journal* 6, 1–21.

Caparrelli, F., Arcangelis, A. M. D., & Cassuto, A. (2004). Herding in the Italian Stock Market: A Case of Behavioral Finance, *The Journal of Behavioral Finance*, 5(4), 222–230.

Chang, E. C., Cheng, J. W., & Khorana, A. (2000). An examination of herd behavior in equity markets: An international perspective. *Journal of Banking & Finance*, 24(10), 1651–1679.

Chiang, T. C., & Zheng, D. (2010). An empirical analysis of herd behavior in global stock markets. *Journal of Banking and Finance*, 34(8), 1911–1921.

Christie, W. G., & Huang, R. D. (1995). Following the Pied Piper: Do Individual Returns Herd around the Market? *Financial Analysts Journal*, 51(4), 31–37.

Correia, B. L. (2016). The European Crisis: Repercussions on the Portuguese Economy, *Athens Journal of Mediterranean Studies*, 129–144.

Demirer, R., & Kutan, A. M. (2006). Does herding behavior exist in Chinese stock markets? *Journal of International Financial Markets, Institutions and Money*, 16(2), 123–142.

Demirer, R., Kutan, A. M., & Chen, C.-D. (2010). Do investors herd in emerging stock markets?: Evidence from the Taiwanese market. *Journal of Economic Behavior & Organization*, 76(2), 283–295.

Devenow, A., & Welch, I. (1996). Rational herding in financial economics. *European Economic Review*, 40(3–5).

Hsu, Y. L. T. L. C. (2015). The Impact of Macroeconomic Factors on The Herding Behaviour of Investors, *Asian Economic and Financial Review*, 5(2), 295–304.

Keynes, John Maynard. *The General Theory of Employment, Interest, and Money* (Chap. 12, 145-153) Cambridge, UK: Palgrave Macmillan, 2018.

Kleinberg, J., & Easley, D. (2013). Network, Crowds, and Markets: Reasoning about a Highly Connected World. *Journal of Chemical Information and Modelling*, 53(9), 1689–1699.

Lao, P., & Singh, H. (2011). Herding behaviour in the Chinese and Indian stock markets. *Journal of Asian Economics*, 22(6), 495–506.

Raafat, R. M., Chater, N., & Frith, C. (2009). Herding in humans. *Trends in Cognitive Sciences*, 13(10), 420-428.

Ramadan, I. Z. (2015). Cross-Sectional Absolute Deviation Approach for Testing the Herd Behavior Theory: The Case of the ASE Index. *International Journal of Economics and Finance*, 7(3), 188–193.