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# Herding in the Portuguese stock market:

## Influences of Covid-19 and ESG

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# Herding in the Portuguese stock market:

## Influences of Covid-19 and ESG

Dissertation presented to Universidade Católica Portuguesa to obtain a Master's degree in Finance

by

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# Abstract

This study observes the propensity of herding in the Portuguese stock market during stable market periods and under the influence of Covid-19, using CSSD and CSAD models. Furthermore, noting the increased attention to ESG and its influence on behavior, this study isolates the Portuguese stocks based on their ESG performance to check if ESG potentializes the herding behavior. Results showed significant evidence that Portuguese investors herded in the period of Covid-19, which presented higher market volatility. This phenomenon was stronger in stocks of firms with better ESG performance, suggesting the positive influence of ESG factors on behavior. Meanwhile, by not finding evidence of herding during stable market periods, this study suggests that ESG may not alone be sufficient to spark this phenomenon.

**Keywords**: Herding, Portuguese stock market, Covid-19, ESG.

Number of words: 10,217

# Resumo

Este estudo observa a propensão ao comportamento de manada (*herding*) na bolsa portuguesa em períodos de estabilidade de mercado e sob a influência do Covid-19, utilizando modelos CSSD e CSAD. Além disso, observando o aumento da atenção a ESG e sua influência no comportamento, este estudo isola as ações portuguesas com base em seu desempenho ESG para verificar se ESG potencializa o comportamento de *herding*. Os resultados mostraram evidências significativas de que os investidores portugueses apresentaram comportamento de manada no período de Covid-19, que apresentou maior volatilidade de marcado. Esse fenômeno foi mais forte em ações de empresas com melhor desempenho ESG, sugerindo a influência positiva de fatores ESG no comportamento. Enquanto isso, ao não encontrar evidências de *herding* durante períodos de estabilidade no mercado, este estudo sugere que apenas ESG pode não ser suficiente para desencadear este fenômeno.

**Palavras-chave**: *Herding*, Bolsa portuguesa, Covid-19, ESG.

Número de palavras: 10.217

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# List of Abbreviations

CFA Institute - Chartered Financial Analysts Institute

CMVM - Portuguese Securities Market Commission

CSR – Corporate Social Responsibility

CSRD - Corporate Sustainability Reporting Directive

CSSD - Cross-Sectional Standard Deviation

CSAD - Cross-Sectional Absolute Deviation

EMH - Efficient Market Hypothesis

ESG – Environmental, Social and Governance

OLS - Ordinary Least Squares

PSI – Portuguese Stock Index

UK – United Kingdom

U.S. – United States of America

# Chapter 1
# Introduction

## 1.1 Contextualization

For long it was believed that investors take rational investment decisions (Boudon, 2003). Rationality was incorporated by Fama (1970) into the Efficient Market Hypothesis (EMH), a milestone that explains the main theories of the standard finance (Statman, 1999). The EMH suggests that stock prices already embedded all available information to it and therefore it would not be possible to outperform the market with trading strategies and higher returns would necessary mean higher risk (Fama, 1970). However, contrasting ideas surged to refuse the EMH as investment decisions are also affected by the influence of human emotions, biases, and heuristics, i.e. Behavioral Finance (Hirshleifer, 2015).

Being one of the most important phenomena within behavioral finance, herding occurs when investors tend to follow the crowd instead of making their own independent decisions (Lekovic, 2020; Spyrou, 2013; Welch, 2000). Herding can be rational, when investors choose to follow others, or irrational, when one´s decisions concurs with the crowd, regardless of any fundamentals (Devenow & Welch, 1996). Both types permit the formation of trends and momentum in the market, which can lead to price mismatches, bubbles and crashes (Lux, 1995).

Herding has increased probability of occurrence during periods of market uncertainty and high volatility, and smaller and more illiquid markets, like the Portuguese, have shown signs of tendency towards this behavior (Vieira & Pereira, 2015). The Portuguese stock market is highly concentrated in its 15 largest firms (PSI components) and shows high sensitiveness to macro-events in the international scenario, which enhances the observation of the occurrence of herding under alternative circumstances (Caiado, 2004; Leite et al. 2018).

Portuguese investors´ propensity to herd suffer the influence from period specificities and stock characteristics, behaving overly rational by analyzing risk-return of stocks or not, consequently deflecting or attracting herding behavior (Christie & Huang, 1995). Investors might act differently in periods of market stability and during the Covid-19, just like ESG performance of stocks might have influence or not on decisions (Benz et al., 2020; Ciciretti et al., 2021; Rubbaniy et al., 2021).

## 1.2 Research Gaps

Most studies covering the influence of non-financial factors in investment decisions were conducted in the U.S. market, even though cross-cultural differences affect the sphere of behavioral finance (Graham et al., 2013). This means that the Portuguese stock market suffers from herding differently from others, however, studies did not exhaustively investigate the thematic (Vieira & Pereira, 2015). Moreover, despite the fact that previous market shocks were capable to ignite Portuguese investor´s tendencies to herd, investors´ behavioral changes were potentialized by the Covid-19 and the pandemic period does not seem to be well explored in the Portuguese stock market (Baek et al., 2020; Leite et al., 2018; Kallinterakis & Ferreira, 2006; Vieira & Pereira, 2015).

Despite ESG being a trendy topic, herding through its lenses is vaguely covered (Benz et al., 2020). In the broader studies of Behavioral Finance, Chan and Milne, (1999) and Rosen et al., (1991) suggested that ESG factors were insufficient to guide behavior, while others suggested that these could, in fact, shape investor´s actions (Bénabou & Tirole, 2010; Benz et al., 2020; Rooh & Hussain, 2022; Starks, 2009; Webley et al., 2001). Furthermore, herding towards ESG stocks might have been potentialized during the Covid-19 as investors might have sought a manner to remediate the problems caused by the crisis (García-Sánches & García-Sánches, 2020; Rubbaniy et al., 2021). However, as far

as observed, no studies were conducted in the Portuguese stock market in this regard.

## 1.3 Research Questions

Knowing that there may be various explanatory variables for behavior, specificities of the Portuguese stock market may lead investors to herd more or less (Christie & Huang, 1995). Based on the research gaps, and knowing that periods of stability in the market can harmonize behavior (Lekovic, 2020; Spyrou, 2013), the natural propensity to herd in the Portuguese market can be found by the first question of this study:

***1. Do Portuguese investors show signs of herding under market stability conditions?***

Stress periods directly impact the propensity to herd in the Portuguese stock market (Christie & Huang, 1995; Leite et al., 2018; Kallinterakis & Ferreira, 2006). As so, results found by the first research question might not explain investors´ behavior during the Covid-19 period, particularly noting the behavioral changes caused by the pandemic crisis (Baek et al., 2020). Therefore, a second question is raised:

***2. Did propensity to herd increase in the Portuguese stock market during the Covid-19 period?***

Noting the higher attention to ESG evidenced by Braz et. al (2023), Gomes et al. (2015) and Carvalho (2023), ESG factors might also influence herding behavior (Benz et al., 2020; Ciciretti et al., 2021; Rubbaniy et al., 2021). However, due to the lack of empirical evidence linking ESG factors to herding in the Portuguese stock

market, it seems to be still unknown if Portuguese investors are more or less tendentious to herd towards stocks with better ESG performance (Bénabou & Tirole, 2010; Benz et al., 2020; Chan and Milne, 1999; Rooh & Hussain, 2022; Rosen et al. 1991; Starks, 2009; Webley et al., 2001). Thus, a third question to be observed is:

***3. Is there more signs of herding behavior to Portuguese stocks with better ESG performance?***

## 1.4 Originality

By including more recent data, contemplating the Covid-19 period and analyzing ESG aspects, this study seems to find no match to the existent analysis of herding in the Portuguese Market. In comparison to Leite et al. (2018), Kallinterakis and Ferreira (2006) and Vieira and Pereira (2015), this study observes potentialities of herding in the Portuguese stock market using more recent data and analyzing behavior during the Covid-19, in addition to observe ESG aspects. Differently from Ciciretti et al. (2021) and Rubbaniy et al. (2021), the present research observes the influence that ESG performance has to investors´ herding behavior on general stocks and analyzes the specificities of the Portuguese market.

## 1.5 Contribution to knowledge

For the academia, this study brings new empirical evidence for potential herding phenomenon in the Portuguese stock market, adds a new observation period to the studies from Leite et al. (2018), Kallinterakis and Ferreira (2006) and Vieira and Pereira (2015) and contributes to the recent development of the ESG´s influence on herding, like Ciciretti et al., (2021), Przychodzen at al. (2016), Rooh and Hussain (2022) and Rubbaniy et al. (2021). By bringing new lights to behavior

during the still obscure Covid-19 period, diffusing new information on herding, and adding ESG factors, this study may help the CMVM to create better policies towards stability in the Portuguese stock market. Moreover, this study may foster ESG causes in Portugal, contribute to investors that can develop better trading strategies, and support Portuguese publicly traded companies in enhancing their communication with the market.

## 1.6 Presentation of next chapters

Based on the purpose of this study, this dissertation is divided into five chapters. The next chapter, Chapter 2, features the main concepts involving herding and ESG, presents the main academic theories, analyzes empirical evidences and deepens in the context of the study. Chapter 3 outlines the methodology, divided into method, data, variables, statistical technique and software utilized for processing the data. Chapter 4 presents the descriptive statistics, shows the main results and brings discussions about them. Lastly, Chapter 5 concludes this work, shows its implications to the various stakeholders previously stated, mentions the possible limitations of this study and suggests future investigation in the topic.

# Chapter 2
# Literature Review

## 2.1 General Concepts

### 2.1.1 Herding

The concept of herding surged from psychology and sociology fields, it was molded along the years and later incorporated to economics and finance. Although no single person can be credited for creating this concept, Keynes (1930) was one of the first studies to define herding, suggesting that this behavior was a response to uncertainty in which people may follow others because they think that the rest is better informed. Years later, Sherif (1966) referred to herding behavior as blindly following the majority, rather than relying on own collection of information and individual thought.

Based on the initial ideas above, Chang et al. (2000) described herding behavior as "tendency to mimic the actions of others", Banerjee (1992) as "people doing what others are doing rather than using their information" and Devenow and Welch (1996) as "behavior patterns that are correlated across individuals". Although these three definitions are prominent, they are too wide and lack emphasis on financial aspects.

Bikhchandani and Sharma (2000) gave a more focused definition as the "intent by investors to copy the behavior of other investors", similarly Sias (2004) described it as "following each other into (or out of) the same securities over some period of time". While these provide better insight into herding behavior, they do not take into account the rational and irrational faces of herding. For that, Spyrou (2013) defines herding as "economic agents imitating each other actions and/or basing their decisions upon the actions of others".

Spyrou explicitly recognizes that herding behavior can involve both the imitation of others' actions and the use of those actions as a basis for making one's

own decisions, which brings an important distinction to the other definitions, as herding may be passive and automatic, but can also be deliberate and strategic. Moreover, knowing that the concept of herding has been molded along the years, Spyrou's definition is chosen going forward as it brings a more recent view on herding while captures the essence of the other definitions described.

### 2.1.2 ESG

With the development of the principles surrounding society and environment, corporations became not only accountable to its shareholders but also to all of those that could affect or be affected by it (Freeman, 1984). Few years later, Elkington (1994) created the term triple bottom line, uniting the tripod (people, profit and planet) as the main strategy for business development. The triple bottom line gave basis to the more recent concept of Corporate Social Responsibility (CSR), which in turn, is the precedent of Environmental, Social, and Governance (ESG).

CSR is defined by the United Nations Industrial Development Organization [UNIDO] (n.d.) as the integration of social and environmental concerns with economic development, and, by the European Commission (2011), as the responsibility of enterprises for their impacts on society and outlines what an enterprise should do to meet that responsibility. The definition of CSR is directly related to ESG, however while CSR holds businesses accountable for their social and environmental commitments, ESG helps to measure or quantify corporate efforts (Hung, 2021).

As the latest concept to be developed, ESG supports the idea that investors are capable to compare environmental, social and governance performances and proactively invest towards sustainability, instead of reacting to businesses sustainable decisions. In this sense, ESG is defined by Rooh and Hussain (2022) as a "set of criteria about companies' processes that investors can use in choosing

possible investments" and by Ciciretti et al. (2021) as "firms' environmental, social, and governance characteristics incorporated in investment decisions". These definitions are very similar to the one given by the widely accessed website Investopedia (n.d.): "set of standards for a company´s behavior used by socially conscious investors to screen potential investments".

Unlike the mentioned definitions that primarily focus on how ESG criteria are used by investors to select investments, the Corporate Finance Institute [CFI] (n.d.) defines ESG as the "framework that helps stakeholders understand how an organization is managing risks and opportunities related to environmental, social, and governance criteria". By emphasizing the importance of ESG criteria in managing risks and opportunities, this definition gives a more comprehensive understanding of ESG, making it particularly relevant for this study, and aligning with the intention to measure herding through the ESG lenses.

## 2.2 Fundamentals of Finance

### 2.2.1 Pillars of Finance and the Efficient Market Hypothesis (EMH)

According to the EMH, investors have homogeneous expectations and are rational decision makers capable to choose what is most beneficial for them based on all available information (Fama, 1970). There are three ways of classifying the EMH: weak, semi-strong and strong forms.

The weak form of the EMH implies that stock prices are set based on all past information, which means no technical analysis can be effectively used to support investors' decision making. The semi-strong form suggests that all publicly available information are reflected on prices (incorporating past information), in this case investors cannot have gains using fundamental nor technical analysis. The Strong form does not only incorporate the other two, but also includes private information. Therefore, stock prices reflect all existing

information, and no investors are able to profit more than the market (Fama, 1970).

Based on the EMH, in theory, it would not be possible to outperform the market as prices are accurately quoted to the available information. Being so, it would not be possible to make a profit from any trading strategy and the only way to earn higher returns is by increasing risk (Fama, 1970). However, the high amount of daily information is an impediment to investors' rational decisioning as humans have limited capacity to hold chunks of information at a time and our brain is only capable of retaining part of the stimuli it receives (Miller, 1956; Solomon, 2011). As such, investors would have a selective attention, ignoring big part of the information received (Kotler, 1998). Moreover, investors perceive information differently and can distort it according to their own values and desires (Kotler, 1998; Malkiel, 2003).

By questioning the EMH, it is inevitable to theorize the possibility that market prices take time to react to new information and that investors can be affected by other factors to reach decisions than purely rational financial analysis. This means that it would be possible to profit from market abnormalities, and non-financial motivators could fill theorical gaps left by the EMH assumptions (Malkiel, 2003; Taffler, 2017).

### 2.2.2 Behavioral Finance

Behavioral finance surged to add psychological elements to the neoclassical economic approach (Hirshleifer, 2015). Instead of avoiding the EMH, behavioral finance intends to supplement it by filling its gaps, explaining potential market inefficiencies and exposing cracks in frictionless models (Charles & Kasilingam, 2016; Hirshleifer, 2015; Shiller, 2003).

Shiller (2003) defines behavioral finance as a scope that incorporates the traditional elements of finance and adds psychology and sociology effects to it in

order to have a broader perspective of the decision-making process. These added effects, however, also add certain subjectivity to how researches identify the existence of behavioral finance, and make it difficult to predict the potential risks and opportunities in the market (Shiller, 2003).

Investors' decision-making process may be shaped by the amount of risk they are willing to take, for what specific factors represent to them, their personality, social situation, cultural values, gender, age, health and financial literacy, among others factors from the most obvious behavioral influencers as mediatic reports to least obvious ones as the weather (Alexandra et al., 2017; Filbeck et al., 2010; Hirshleifer & Shumway, 2003; Jamali, 2007; James et al., 2012; Khalid et al. 2021; Li et al., 2021; Nath et al., 2013; Schuethm, 2003; Shiller, 2003). Although many different theories can be raised to explain behavior, authors have common goal: the explanation of why it not uncommon for some investors to hold on losing securities and sell winners too soon. To answer this question, studies converge into the idea that even though investors may strive to take rational decisions, they may rely on heuristics, suffer influence of their emotions and be susceptible to take biased actions (Thaler, 1999).

Heuristics can be defined as mental shortcuts or rules of thumb that people use to simplify complex decisions, therefore, triggering their unconscious mind to reach quick decisions (Kamble 2021). By relying on heuristics, investors reduce their cognitive workload, which can lead to efficiency, but also to irrational and suboptimal decision-making. As heuristics anesthetizes investors' rationality, many bad decisions could be reverted if the conscious mind is triggered (Trivers, 1991).

As investors are in constant conflict between involuntary emotional inputs and voluntary rational thoughts, even small swings on emotional states can be sufficient to affect behavior (Charles & Kasilingam, 2016). Positive emotions might lead to riskier decisions, making investors more prompt to open positions,

to pursue buying strategies and to rely on prejudgments (Bless et al., 1990; Hirshleifer, 2015; Kuhnen & Knutson, 2011). For this reason, Forgas (1995) mentions that being in a good mood has a similar effect as heuristics because investors increase the speed for reaching a decision. Oppositely, negative emotions encourage closing positions and selling strategies, as investors become more careful and risk-averse, reducing their expectations of return (Bless et al., 1990; Hirshleifer, 2015; Lerner & Keltner, 2001; Statman, 2014 ).

Due to heuristics, emotions, blind beliefs, way of thinking and interpreting information, education and memory failures, investors become vulnerable to cognitive biases (Hirshleifer, 2015; Thaler, 1999). As there is a great variety of biases, Table 1 summarizes some of the most discussed ones:

**Table 1 - Common cognitive biases**

| Name of cognitive bias | Description |
|---|---|
| Anchoring | Overly rely on the first piece of information. |
| Authority | Solely rely on the opinion of authorities or experts to reach decisions. |
| Availability | Over or underestimate the performance of securities based on the available information on their memory. |
| Confirmation | Only search for, focus and remember the information that confirms own opinion. |
| Consensus | Assume that the majority is right. |
| Emotional | When emotional states lead to wrong rationalization. |
| Fallacy | Wrong reasoning to explain facts. |
| Hindsight | Find justifications for past mistakes and blocks future learnings. |
| Loss Aversion | Interpret losses and gains differently given similar situations. |
| Overconfidence | Trust more their own abilities and judgments than evidences. |
| Representativeness | Trust too much on similar past experiences and stereotypes to reach conclusions |
| Similarity | Completely trust on the decisions from similar peers to guide actions. |

*Source: Author*

The interrelation of cognitive biases can bring lights on the decision-making process. For example, the anchoring bias can influence perception of value by relying too heavily on the first piece of information encountered, while the confirmation and availability biases can lead to seek out and interpret information in a way that confirms pre-existing beliefs. These biases can reinforce each other, leading to suboptimal decisions by ignoring pieces of information. (Andersen, 2010; Klayman, 1995).

Similarly, the authority bias, where investors are likely to follow the opinion of an authority figure, can work together with the consensus bias, where they are more likely to see the group as being right. Loss aversion and hindsight bias can also play a role in decision-making, leading investors to take decisions based on past-looking and pessimistic interpretations rather than rationally analyzing possibilities (Kahneman & Tversky, 1979; Lekovic, 2020). Representativeness and similarity biases can lead investors to rely too heavily on stereotypes or prior experiences, rather than considering the individual circumstances of each decision. Overconfidence and fallacy biases can relate as too optimistic investors can overestimate their abilities and knowledge, which leads to wrong reasoning (Ehrlinger et al., 2016).

## 2.3 Herding Behavior

Being one of the most well-known examples of how behavioral finance can play a role in financial markets, there is a vast literature trying to find explanatory reasons for herding (Welch, 2000). Individual investors can potentially herd as consequence of deriving knowledge from the action of major market participants, responding to new information in an equally manner, seeking investment protection, acting according to psychological or social conventions or simply due to irrational reasons. Meanwhile, institutional investors may not only be prompt to herd for the reasons above, as they can also herd as consequence of corporate benefits and reputational safeguard. (Spyrou, 2013; Leckovic, 2020; Welch, 2000).

In order to better understand this phenomenon, Devenow and Welch (1996) raise the importance of distinguishing between rational and irrational herding, as investors can be intentionally herding for believing in the benefits to do so, while others can simply be irrationally herding.

### 2.3.1 Irrational herding

The cases in which investors blindly follow others, being completely absent of rational analysis, are called irrational herding. This refers to the behavior that urges when one faces difficulty in constructing rational actions, thus unconsciously relying on the group´s actions to reach a decision (Devenow and Welch, 1996; Welch, 2000).

Irrational herding can be seen when there is lack of information or when the near future foresees high uncertainty, which leads to generalized limitation of market knowledge and similar previous experiences (Lekovic, 2020; Spyrou, 2013). Information deficit and uncertainty potentially instigate the herd to act irrationally, which leads to high mismatches between real value of securities and their respective actual price (Lin et al., 2013).

But investors can also be irrationally herding in environments where information is available, by passively imitating others while neglecting the existing information. This behavior can be explained by psychological and social effects like biases and emotions which contribute to an impulsive unexplained behavior. Due to the randomness of the blind decisions taken under irrational herding, it is hard to establish with confidence when it is present and if decisions were purely irrational, as investors can still be partially acting with rationality (Devenow and Welch, 1996).

### 2.3.2 Rational herding

Rational herding happens when investors choose to adopt the same strategies to others (Devenow & Welch, 1996). By having rational decisioning, it is possible to raise questions over the reasons why investors decide to follow others, if they are searching for financial advantages, non-financial benefits, or simply finding shortcut for decisions.

In theory, the rational herd would take more time to reach decisions, be more careful on the amounts to be invested, better measure risk-return effects and

supposedly take better investment choices (Charles & Kasilingam, 2016). Although, Welch (2000) explains that evidences of the effectiveness of herding for risk-return are still sparce, which means that the decision to herd might not be backed by financial advantage.

Bikhchandani and Sharma (2000) mention that there are many potential factors that lead to rationally herd, the most common being: (i) imperfection of the available information, (ii) reputational reasons and (iii) compensation structures.

(i) Information might not be received at the same rate and interpreted in the same manner, therefore, investors might follow others for assuming that these have better information (Bikhchandani & Sharma, 2000). Deutsch and Gerard (1955) use the term ´informational influence´ to refer to this case, as the herd can be tendentious to rely on authorities and experts to guide decisions for believing these are better informed.

Information imperfection also brings an important distinction between rational and irrational herding. Whereas, rational herding is information-based, which means that investors can choose to act on the available information or intentionally neglect it, while irrational herding can surge from lack of information or its blind neglection (Bikhchandani & Sharma, 2000; Devenow & Welch, 1996).

(ii) Due to the common belief that ´if everybody does, no one can question my actions´, investors can safeguard their reputation and preserve their image among peers by complying with the crowd (Spyrou, 2013). Essentially, estimated members of a group can lose respect if their analysis differs from the market tendency and lead to losses. Therefore, by rationally herding, investors could share the blame with the market and release negative attachments to their own image (Scharfstein & Stein, 1990).

(iii) Herding behavior can be stimulated when institutional investors´ compensation is linked to the degree of conformity that their decisions have with other professionals. Therefore, there are financial benefits for seeking compliance with the market trend (Bikhchandani & Sharma, 2000).

Leckovic (2020) mention that the social reasoning behind the rational herding behavior is very strong, as a bad collective decision is less regretful than a sole personal decision. However, social reasoning goes beyond that, investors can have some kind of relationship or share similar characteristics with others, which stimulates the desire of peer compliance, called by Deutsch and Gerard (1955) as ´normative influence´. Moreover, working similarly to the relationship of many animal species which feel safer by following the herd, investors might seek comfort and protection by being compliant to the group, as they believe that their investments are safer by copying general social trend (Leckovic, 2020; Spyrou, 2013; Welch, 2000).

Based on Bikhchandani and Sharma (2000) rational herding can be divided in two: the ´intentional´ and the ´spurious´. The intentional herding surges when investors choose to copy others because by doing so, they would collect benefits of their own. Meanwhile, the spurious herding is when investors respond in a similar manner to a common information. Bikhchandani and Sharma (2000) suggest that spurious herding can lead to efficient financial outcomes as it means raising own analysis, while intentional herding is suboptimal.

Spyrou (2013) mention that independently of reasons for herding, it can create a disastrous chain of events. Herding behavior can create momentum, inefficiencies, asset bubbles and crashes in the market (Lux, 1995). Moreover, herd investors stimulate unpredictable price changes, which can lead to devastating financial consequences for those who do not have diversified portfolios and become heavily exposed to the securities experiencing herding behavior.

## 2.4 Covid-19 and Herding

Hwang and Salmon (2004) suggest that during periods of crisis there is more uncertainty and investors become less confident in the market direction, which is unfavorable to herding. Despite that, most studies agree with Christie and Huang (1995) who theorized that herding has higher probability to occur during stress periods, as these lead to higher uncertainty and volatility. This might be the case of an economic turmoil, such as the global financial crisis of 2008 and the recent outbreak of Covid-19, as financial markets pessimistically reacted to the global scenario (Ullah, 2022).

During higher uncertainty periods, investors lack clear information about market conditions or the prospects of individual investments, therefore, looking to others for guidance (Spyrou, 2013). This can lead to a situation where a large number of investors follow the same investment strategies or make the same investment decisions, leading to herding behavior (Lekovic, 2020). Moreover, due to the strong impact of Covid-19 to society, investors may have also experienced unfavorable emotions, such as fear or anxiety, making them less concerned about possible gains and more worried about losses, which can initiate a tendency to follow others (Bless et al., 1990; Hirshleifer, 2015; Lerner & Keltner, 2001; Statman, 2014).

## 2.5 ESG and Herding

By adding ESG to the analysis, investors increased the focus in non-financial factors, and made them capable to identify potential investment risks and opportunities (Hoffmann & Fieseler, 2012; Low & Siesfeld, 1998). However, investors might not significantly react to good ESG practices from corporations, as they might not be willing to sacrifice their financial return because of ESG (Chan and Milne, 1999; Rosen et al., 1991). Meanwhile, others might keep ethical investments even if they under-perform financially (Webley et al., 2001).

ESG thematic may spark herding phenomenon in various ways, for example, investors can jump on board of a particular strategy that others created surrounding ESG factors. (Benz et al., 2020; Ciciretti et al., 2021; Rubbaniy et al., 2021). But ESG can also have the oppositive effect as those that take ESG factors into their analysis would carefully check each particular stock, thus avoiding or mitigating the herding phenomenon (Choi et al., 2021; Giese et al., 2019).

Knowing that among the reasons for herding, reputation safeguarding and social aspects play an important role, if the overall market invests in ESG, investors could herd to not look bad to the group. However, as the society sees with good eyes those that support societal and environmental causes, if the overall market does not invest in ESG, investing in ESG can be well seen by peers. Therefore, ESG can lead to herd or anti-herd phenomena (Leckovic, 2020; Spyrou, 2013).

According to Oldford et al. (2021), investors with higher prestige are the first ones to manage their portfolios taking ESG into account. If this is the case, the herd can be influenced by ´authority cognitive bias´, as they are entrusting their decisions to experts and prestigious investors. Meanwhile, these same authorities can be intentionally leading the herd by raising their ESG investments, in order to trigger a domino effect and make others also invest in environmental and social causes (Benz et al., 2020).

## 2.6 Empirical Evidence

### 2.6.1 Signs of herding

Evidences of herding were searched worldwide and led to various results. For example, Christie and Huang (1995) found no evidence to prove herding as a determinant factor of behavior in the US market, which is confirmed by the studies of Chang et al. (2000). By analyzing alternative stock markets, Chang et al. (2000) did not find evidence of herding in Hong Kong, but found in South

Korea and Taiwan, the latter confirms the conclusions of Lin et al. (2013). Economou et al., (2011) found no signs of herding in the Spanish stock market, while found in the Greek and Italian, the latter being confirmed by Caparrelli et al. (2010).

When it comes to the Portuguese market, there is a natural propensity to herding because of its highly sensitiveness to variations on the European and American scenario (Caiado, 2004). In addition, Leite et al. (2018) show that cases of herding can commonly occur as investors are propense to fall into the impression that they can collect benefits from following others. This is specifically the case when it comes to the participants of the Portuguese Stock Index (PSI), as these are the largest firms of Portugal and are expected to have higher liquidity and greater prospects of gains, consequently, attracting the herd (Leite et al, 2018).

Leite at al. (2018) found high records of herding behavior in the Portuguese market between 1998 and 2010, especially when observing higher price volatility. This is consistent with the results from Kallinterakis and Ferreira (2006) that found significant herding between 1996 and 1999. During these periods, however, mixed results were found by Economou et al. (2011) and Vieira and Pereira (2015). When employing an equally weighted portfolio and a value weighted portfolio for Portuguese stocks, Economou et al. (2011) found no signs of herding in the former, while the latter presented significant signs. Vieira and Pereira (2015) took two different approaches to measure herding and got contrasting results.

Noting the sudden changes that the world experienced caused by the Covid-19 pandemic, preliminary studies showed that the Covid-19 was capable to influence investor´s behavior and affect stock returns of international markets at some point (Alzyadat & Asfoura, 2021; Hung et al., 2021, Ullah, 2022). This influence in behavior brought a significant difference in the results from Ampofo

et al. (2023) that concluded that before Covid-19, the UK and USA markets presented no herding, but during Covid-19, both markets showed significant signs of herding. However, these results partially contrast with Rubesam and Júnior (2022) that found no evidence of herding in UK, while finding in the U.S., during Covid-19. Rubesam and Júnior studied 10 markets and found herding in only three of them (Italy, Sweden and U.S.), which led authors to conclude that there was limited evidence of herding during the Covid-19 period.

Kizys et al. (2021) analyzed data from the PSI participants and concluded that herding was present during Covid-19. However, these authors analyzed 72 countries at once, which raises questions on whether presence of herding from specific countries influenced overall results. Moreover, as Economou et al., (2011) had found a strong correlation between the Spanish, Italian and the Portuguese markets when it comes to herding, the result from Rubesam and Júnior (2022) showed above could indicate potentialities for this behavior in Portugal. Although, no previous individual analysis of herding in the Portuguese stock market during Covid-19 was found.

### 2.6.2 ESG influence in herding

According to the conclusions of Rooh and Hussain (2022), there are no significant relationship between ESG factors and herding behavior. This result contradicts the studies from Benz et al. (2020), Ciciretti et al. (2021) and Rubbaniy et al. (2021) that found a positive correlation between ESG and herding behavior, and from Choi et al. (2021) and Giese et al. (2019) that found that ESG factors negatively affected evidence of herding.

The Covid-19 situation presented favorable aspects to ESG investments. García-Sánches and García-Sánches (2020) found evidence that companies increased their investments in ESG to alleviate the consequences of the Covid-19. At individual level it was no different, Garel and Petit-Romec (2021) found that

being more environmentally friendly, enhanced interest from investors during this period. Consequently, Cardillo et al. (2023) found that stocks with higher ESG scores performed better than those with low score, which was particularly evident whenever public news about cases of and deaths by Covid-19 were released. Similarly, Albuquerque et al. (2020) found that at the peak of the pandemic, higher ESG scores led to higher returns and lower return volatilities.

The influence of Covid-19 also impacted the relation of ESG and herding. Lee et al. (2021) concluded that due to the Covid-19, ESG factors played a more important role and herding behavior became evidenced. Rubbaniy et al. (2021) found that there was already herding towards ESG stocks in the US market before Covid-19, but during the Covid-19 period it became more evident, as investors suppressed their own beliefs and completely ignored fundamental reason by simply mimicking others.

## 2.7 Contextualization

### 2.7.1 Portuguese Market

The Portuguese stock market (Euronext Lisbon) is relatively small and less liquid if compared to some of other European markets, such as the London Stock Exchange, Six Swiss Exchange and Deutsche Börse. However, it is an important player in the Portuguese economy and provides a platform for companies to raise capital and investors to trade securities. Its market capitalization was of €83 billion at the end of 2022, with average daily trades of €137 million.

The main index of the Portuguese stock market is the PSI, which tracks the performance of the largest and most liquid companies listed on the exchange. The PSI has experienced significant fluctuations due to various economic and political factors. For example, the global financial crisis of 2008 had a major impact on the Portuguese economy and led to a decline in stock prices.

According to CMVM (2009), the Portuguese stock market was only 10% composed by individual domestic investors, far below other comparable European markets like Spain (20%), Italy (27%) and Greece (19%). Meanwhile, 45% of investments come from international investors, being above the European average (37%). Institutional investors (including foreign investments) compose the remaining part, from which, as per Euronext Lisbon data from 2022, 10% is controlled by three Chinese state companies (China Three Gorges, State Grid of China and China Communications Construction Company), and 9% by Soares dos Santos family that controls 56% of Jerónimo Martins (largest component of the PSI) (Leitão, 2022).

To encourage more investments, the government and regulatory authorities have taken steps to promote the development of the Portuguese stock market. For example, there are transparency rules for the listed companies on the Portuguese stock market, like the obligation to disclosure financial statements or material events to public, and investigations to avoid market manipulation, like dissemination of false or misleading information.

When it comes to ESG, the European Union imposes laws and regulations to all constituent countries, such as the European Ecological Pact (Green Deal), the Corporate Sustainability Reporting Directive (CSRD) and the Taxonomy Regulation. Additionally, Portugal has been quickly reacting to ESG concerns, being, for example, the first country to commit to carbon neutrality until 2050 (Braz et. al, 2023).

As a result of the regulatory efforts, market transparency increases and Portuguese investors are better informed to take decisions. For example, Portuguese firms (specially the largest ones) have been improving the quality of their ESG reports, which allows investors to incorporate ESG factors into their investment decisions (Gomes et al., 2015).

### 2.7.2 Covid-19 period

The first case of COVID-19 was identified in China in December 2019, by the end of the following month, the disease was already declared as a global emergency and directly impacted the economy, society and environment (Kaye et al. 2021).

World´s economy suffered a tremendous setback, as the generalized uncertainty led to supply chain disruptions, business closures and high volatility in the stock markets (Baek et al., 2020). To try to remedy the situation, central banks cut interest rates, allowed the temporary suspension of loan repayments and extended credit lines to stimulate economic activities.

Societal behavior was highly impacted by social distancing, disruption of celebrations, travel ban, closure of entertainment and food businesses, and difficulty to continue with proper educational plans (Debata et al., 2020; Haleem et al., 2020).

In the opposite direction, due to industries shutdown and decreased economic activities, environment was positively affected, being recovered to a higher extent than any other efforts made in this century (Debata et al., 2020; Verma & Prakash, 2020).

## 2.8 Hypotheses

In order to answer the research questions of this study, give explanation for the herding phenomenon under the stable and Covid-19 periods and find the potentialities of increasing this behavior due to ESG performance, different hypotheses can be tested.

Knowing that when there is higher uncertainty, herding tend to be more common and at higher levels, periods of economic stability are to be unfavorable for such behavior (Lekovic, 2020; Spyrou, 2013). This was the case shown in the U.S. and UK markets as per Ampofo et al. (2023). However, this relationship

works differently in each market (Graham et al., 2013). The Portuguese stock market strongly reacts to international scenarios and have more frequent periods of high volatility when compared to larger markets, which makes investors more propense to herd even in periods of higher stability (Caiado, 2004; Leite et al., 2018). Therefore, the first hypothesis can be raised:

Hypothesis 1 ($H_1$): There are significance signs of herding behavior in the Portuguese stock market under ´normal conditions´.

During stress periods, empirical evidence found sings of herding in the Italian, Greek, Taiwanese, South Korean and Portuguese stock markets. (Chang et al., 2000; Economou et al., 2011; Caparrelli et al., 2004; Kallinterakis & Ferreira, 2006; Leite et al., 2018; Lin et al., 2013). However, different stress periods might lead to different results, as shown by Christie and Huang (1995) and Chang et al., (2000) that found no evidence of herding in the U.S. market, which is different from the evidence found by Ampofo et al. (2023) and Rubesam and Júnior (2022).

Knowing that the Covid-19 crisis brought uncertain scenarios to global markets (Baek et al., 2020), Lee et al. (2021) suggest that the Covid-19 was capable to ignite the herding behavior, despite the risk-return characteristics of each stock. However, Hwang and Salmon (2004) suggested that under uncertainty, investors actually avoid herding, which was the case for Rubesam and Júnior (2022) that found limited evidence of herding during this period. Moreover, empirical studies conducted during the period found contrasting results as evidenced by Ampofo et al. (2023) and Rubesam and Júnior (2022) regarding the UK market. As individualities of the Portuguese market were not isolated by Kizys et al. (2021), and results found in the Italian cannot be translated to the Portuguese market (despite their correlation) (Economou et al. 2011; Rubesam & Júnior 2022), no previous evidence of potentialities of herding in the Portuguese

market during Covid-19 were found. Therefore, the second hypothesis was this study is:

Hypothesis 2 ($H_2$): During the Covid-19, investors of the Portuguese stock market show significant signs of herding.

Taking into account the higher attention given to ESG lately, ESG factors might also increase investors´ tendency to herd towards stocks with better ESG footprint (Benz et al., 2020; Ciciretti et al., 2021; Rubbaniy et al., 2021). In Portugal, higher attention to ESG is evidenced by the various legislation being developed in this area (Braz et. al, 2023), the importance given by large corporations to sustainable reports (Gomes et al., 2015) and the increasing potential observed in ESG investment funds (Carvalho, 2023). Although, this attention might potentialize herding to ESG stocks in the Portuguese stock market, the influence of ESG in behavior is questionable (Chan & Milne, 1999; Rooh & Hussain, 2022; Rosen et al., 1991), and Choi et al., (2021) and Giese et al., (2019) concluded that as investors that focus in ESG are more rational, they are less prompt to herd. Noting that no evidence was found for the relationship between herding and ESG in the Portuguese stock market, and taking in consideration that ESG investing were potentialized during Covid-19 in order to alleviate the environmental and social consequences of the virus (García-Sánches & García-Sánches, 2020; Lee et al., 2021), a third hypothesis to be observed is:

Hypothesis 3 ($H_3$): Herding behavior becomes more evident in Portuguese stocks with better ESG performance.

# Chapter 3
# Methodology

## 3.1 Method

While qualitative studies could be used to explore different facets and perspectives involved in herding phenomenon, this method shows subjectivity that can lead to erroneous conclusions and difficulty to replicate (Denzin & Lincoln, 2000; Lincoln & Guba, 1985). Therefore, noting that Spyrou (2013) concluded that market consensus can be an efficient manner to measure herding in south European stock markets, this study uses the quantitative approach, in accordance to the prominent studies from Christie and Huang (1995), Chang et al. (2000) and Chiang and Zheng (2010).

## 3.2 Data

Christie and Huang (1995), Chang et al. (2000) and Chiang and Zheng (2010) say that abnormal volatilities in returns can be used as a proxy to identify investors´ behavior and finding herding phenomenon. Christie and Huang (1995) indicated that herding usually happens in a short-term period, being observed by analyzing frequent data. Therefore, to find if there is evidence of herding in the Portuguese stock market, this study uses panel data by collecting daily closing prices from the stock sample of the Portuguese Stock Index (PSI)[1] components. This secondary data is found through Yahoo! Finance platform as this not only possesses accurate information as it also has advantageous propositions for having free access and being widespread accessible for researches (Yu & Chen, 2021).

[1] Composed by the largest companies in Portugal, commonly used as a proxy of investments in Portugal´s main stock market (Euronext Lisbon) (Ferreira, 2021).

According to Amiraslani et at. (2017) and Giannarakis and Theotokas (2011), a crisis period is capable to modify behavior, thus, market stability period is set from 2015 to 2019, when investors´ behavior can be analyzed under ´normal condition´[2], without major influencers in the macro-economic scenario. 2020 and 2021, the most affected years by the Covid-19 crisis according to the World Bank (2022), and its consequences until the 31st of January 2022 are used as the Covid-19 period[3].

With the purpose to find ESG performance of the PSI participants, this study uses ESG Ratings as a proxy, as previously done by Yoon et al. (2018), Feng et al. (2022) and Jarjir et al. (2022). This data can be retrieved from websites of the main ESG rating agencies worldwide, such as Sustainalytics and Refinitv (Avramov et al., 2021). To strengthen the observation of ESG factors in the Portuguese market, the ESG ranking made in 2021 by the Corporate Reputation Business Monitor [Merco][4] is also included.

Table 2 illustrates the composition of PSI on 31st of December 2022, general financial performance of participants as per financial year 2021, and their ESG scores. As Greenvolt´s stocks first trading day was on the 16th of July 2021, it was excluded from the final sample to avoid disturbance on results.

[2] Normal condition period avoids the 2007-2008 financial crisis and the subsequent crisis that hit the Portuguese market in the years from 2010 to 2014.
[3] Covid-19 period avoids potential market disturbances occurred by the conflict between Russia and Ukraine that started in February 2022
[4] Merco´s ESG ranking is based on opinion of executives, government, financial analysts, NGOs, among other relevant actors in Portugal.

**Table 2 – PSI components overview**

| # | Company | Sector | % of PSI | General financials | | | | ESG Scores | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Market Cap (billion €) | EPS (€) | Beta | Revenue (million €) | Refitinitiv | Sustainalytics | Merco |
| 1 | Altri | Basic Resources | 2.57 | 1.00 | 0.73 | 1.10 | 785.21 | 60 | 19.3 | 33.85 |
| 2 | Banco Comercial Português | Financials | 9.24 | 3.43 | 0.01 | 1.77 | 2,508.81 | 77 | 21.6 | 42.8 |
| 3 | Corticeira Amorim | Industrials | 2.91 | 1.31 | 0.61 | 0.66 | 837.82 | 78 | 14.7 | 57.49 |
| 4 | CTT Correios de Portugal | Industrials | 2.70 | 0.53 | 0.26 | 1.11 | 813.50 | 64 | 17.1 | 40.81 |
| 5 | Energias de Portugal (EDP) | Utilities | 12.88 | 20.22 | 0.17 | 0.48 | 14,982.90 | 87 | 20 | 75.44 |
| 6 | EDP Renováveis | Utilities | 11.05 | 20.80 | 0.64 | 0.52 | 1,760.53 | 77 | 15.9 | 75.44 |
| 7 | Galp Energia | Energy | 14.13 | 8.03 | 1.43 | 0.88 | 16,111.00 | 74 | 26.2 | 72.42 |
| 8 | Greenvolt | Utilities | 3.17 | 0.93 | 0.15 | 0.58 | 140.64 | 62 | 25.1 | 68 |
| 9 | Jerónimo Martins | Consumer Staples | 12.15 | 13.31 | 0.89 | 0.43 | 20,889.00 | 83 | 14.1 | 73.85 |
| 10 | Mota-Engil | Industrials | 0.90 | 0.49 | 0.08 | 1.57 | 2,591.77 | 63 | 22 | 38.77 |
| 11 | NOS | Telecommunications | 5.70 | 2.16 | 0.44 | 0.63 | 1,430.29 | 63 | 15 | 54.49 |
| 12 | Redes Energéticas Nacionais | Utilities | 7.73 | 1.71 | 0.21 | 0.35 | 781.08 | 73 | 18.3 | 54.25 |
| 13 | Semapa | Basic Resources | 1.68 | 1.13 | 3.85 | 1.25 | 2,131.38 | 60 | 31.5 | 21.25 |
| 14 | Sonae | Consumer Staples | 7.03 | 2.02 | 0.17 | 1.03 | 7,023.28 | 79 | 20.6 | 83.14 |
| 15 | The Navigator Company | Basic Resources | 6.16 | 2.45 | 0.46 | 1.02 | 1,595.87 | 74 | 16.5 | 48.44 |

*Source: PSI Composition, Euronext, 31st December 2022. Yahoo! Finance, , 21st March 2023.*

## 3.3 Variables

Two of the most prestige approaches are used to find signs of herding in the Portuguese stock market: Cross-Sectional Standard Deviation (CSSD) from Christie and Huang (1995) and the Cross-Sectional Absolute Deviation (CSAD) from Chang et al. (2000). Dependent and independent variables used by CSSD and CSAD models are derived from the return of stocks and the market. Therefore, daily close stock prices of the PSI components (P) are used to find the natural logarithm return of stocks (R) over the observation period (t):

$$(1)\ R\mathrm{t} = \ln\left(P_\mathrm{t} \,/\, P_{\mathrm{t}-1}\right)$$

The advantages of finding log returns in comparison to other return measures are: stocks additivity (overall return of PSI can be calculated as the sum of returns of its components), time additivity (returns over the time is found through summing periods) and symmetry (positive and negative returns have the same magnitude) (Hughson et al. 2006).

Based on the approach from Avramov et al., (2021), to avoid distortions of a particular ESG agency and potential biased opinions, as well as to improve the representativeness of the ESG factor in each stock, ratings for the components of PSI are found through averaging the ESG scores given by Sustainalytics, Refinitv, and Merco. For that, it is necessary to adjust for the difference in ESG score ranges used by each rating agency. Sustainalytics scores (S) are divided in 5 categories ranging from 0-10 (negligible ESG risk) to 40+ (severe ESG risk), Refinitv´s (R) scores go from the worse 0 to the best 100, and Merco´s (M) raking go up to 10.000. For comparability reasons, Sustainalytics maximum ESG rating is set at 40, thus an ESG averaged scores (AvrESG) for each stock in a scale up to 100 can be found through the formula below:

$$(2) AvrESG = \left[\frac{(100 - \frac{S * 100}{40}) + R + (\frac{M}{100})}{3}\right]$$

## 3.4 Main methodology

Christie and Huang (1995) cite that the variability in stock returns could reflect the presence of herds that input irrational decisions and trigger inefficiency in market prices. As a result, the authors measure the dispersion of return data of individual stocks to the market mean through the CSSD model, where the more individual returns deviate from the mean, the more is the level of dispersion:

$$(3)\ CSSD_t = \sqrt{\frac{\sum_{i=1}^{n}(Ri_t - Rm_t)^2}{n-1}}$$

The idea behind the CSSD is that, with the leaps in market prices, investors under the EMH would take into account the sensitiveness of individual stocks in order to take decisions. However, in the presence of herding, they would follow the market trend and overall dispersion would be reduced. Therefore, if CSSD decreases when the market significantly moves up or down, investors are no longer analyzing stocks individually and treating them according to the overall market signal, meaning, following the opinions of others (i.e. herding) (Chang et al., 2000; Chiang & Zheng, 2010; Christie & Huang, 1995).

CSSD method uses two dummy independent variables that represent the periods of when market returns lie in the extreme upper tail of a normal distribution (U), and the opposite scenario when market returns are in the extreme lower tail of the normal distribution (L). Due to the arbitrary definition of extreme market movements, knowing the size of the sample and the observed period of this study, dummy variables $U_t$ and $L_t$ are found by restricting to the 5% extremes of the return distribution as one of the criteria used by Christie and Huang (1995):

$$(4)\ U_t = 1\ if\ Rm_t\ is\ in\ the\ 5\%\ upper\ tail\ of\ the\ return\ distribution, otherwise\ 0$$

$$(5)\ L_t = 1\ if\ Rm_t\ is\ in\ the\ 5\%\ lower\ tail\ of\ the\ return\ distribution, otherwise\ 0$$

To empirically evaluate the presence of herding, the Ordinary Least Squares (OLS) method is used not only for simplicity and interpretability of the results, but based on linear unbiased estimators, it is capable to obtain optimal results by providing a minimum-variance estimation. Therefore, as per Christie & Huang (1995), the following cross sectional standard deviation regression is run:

$$(6)\ CSSD_t = \alpha + \beta_1 U_t + \beta_2 L_t + \varepsilon_t$$

Based on the standard asset pricing models, like the widely used Capital Asset Pricing Model (CAPM), it is assumed that returns are linearly dispersed in relation to market´s return, so, through this formula, Christie and Huang (1995) suggest that in a scenario without the presence of herding behavior, the coefficients of the dummy variable are positive.

Chang et al. (2000) argued that by using absolute deviation and a non-linear model, instead of standard deviation and linear model as per CSSD model, it would be possible to evaluate herding with a greater precision. Following Chang et al. (2000) ideas, a different dependent variable can be found by:

$$(7)\ CSAD_t = \frac{\sum_{i=1}^{n}(|Ri_t - Rm_t|)}{n}$$

Based on the CSAD variable, this study uses the Chiang and Zheng (2010) model to run a new OLS regression model to test for herding:

$$(8)\ CSAD_t = \alpha + \beta_1 Rm_t + \beta_2 |Rm_t| + \beta_3 Rm_t^2 + \varepsilon_t$$

This secondary model is capable to measure asymmetric behavior under alternate market conditions by analyzing $\beta_1$, the intensity of relation between market returns related to the cross sectional absolute deviation with $\beta_2$, and the presence of herding behavior with the analysis of the relation between squared market return and the cross sectional absolute deviation with $\beta_3$. Therefore, the presence of herding behavior can be confirmed if $\beta_3$ is negative and shows significance according to p-value and relevance according to R-squared.

Collected data is divided into the periods of market stability and under Covid-19 and two fictitious equally divided portfolios are created under ESG lenses: one

composed by the half best ESG performance and the other by the remaining half, hereafter called ´ESG portfolio´ and ´Non-ESG portfolio´ respectively. Therefore, both CSSD and CSAD models are used in both portfolios and periods, in order to check for the presence of herding.

## 3.6 Software

There are various software capable to perform data management and statistical analysis, such as: Excel, R, SAS and Stata. Comparatively, Stata emerged as a powerful tool capable to efficiently run regressions in a more accurate manner than Excel, while taking the advantage of being more user-friendly approach if compared to SAS and R, being thus, the software chosen to conduct this study (Acock, 2005).

# Chapter 4
# Results and Discussion

## 4.1 Descriptive statistics

Collected data is divided based on the averaged ESG score of stocks as per results of formula (2), the 7 best averaged ESG scores (all with averaged ESG above 60%) are included in the ESG portfolio and the others included in the Non-ESG portfolio as per Table 3.

**Table 3 – Division of portfolios**

| | Company | Averaged ESG (in %) |
|---|---|---|
| ESG Portfolio | Energias de Portugal (EDP) | 70.8% |
| | EDP Renováveis | 64.1% |
| | Galp Energia | 70.6% |
| | Jerónimo Martins | 64.0% |
| | Redes Energéticas Nacionais | 65.3% |
| | Semapa | 67.7% |
| | Sonae | 71.2% |
| Non-ESG Portfolio | Altri | 48.5% |
| | Banco Comercial Português | 57.9% |
| | Corticeira Amorim | 57.4% |
| | CTT Correios de Portugal | 49.2% |
| | Mota-Engil | 52.3% |
| | NOS | 51.7% |
| | The Navigator Company | 54.6% |

The four divisions of data as proposed by this study are summarized by central tendency, extreme values and dispersion: (i) Table 4 shows the Non-ESG portfolio under normal condition. (ii) Table 5, the Non-ESG portfolio under

Covid-19. (iii) Table 6, the ESG portfolio under normal condition. (iv) Table 7, the ESG portfolio under Covid-19.

By comparing Tables 4 and 5, one can see that with the exception of Coticeira Amorim and Altri, the other stocks of the portfolio had decreased price mean during Covid-19. This is according to the expectation for a crisis period and due to the impact of Covid-19 in the economy (Debata et al., 2020). This can also explain why all stocks of the Non-ESG portfolio showed lower maximum values during Covid-19.

**Table 4 – Descriptive statistics (Non-ESG portfolio - normal condition)**

| | Central tendency (in €) | | | Extreme values (in €) | | Dispertion | | |
|---|---|---|---|---|---|---|---|---|
| **Company** | **Mean** | **Mode** | **Median** | **Max** | **Min** | **σ** | **Skewness** | **Kurtosis** |
| Altri | 4.96 | 5.51 | 4.38 | 9.13 | 2.50 | 1.5996 | 0.7994 | -0.3050 |
| Banco Comercial Português | 0.39 | 0.23 | 0.25 | 1.24 | 0.14 | 0.2818 | 1.6327 | 1.3936 |
| Corticeira Amorim | 8.67 | 10.64 | 9.63 | 13.18 | 3.00 | 2.6852 | -0.5865 | -0.9401 |
| CTT Correios de Portugal | 5.65 | 3.23 | 5.28 | 10.83 | 1.86 | 2.7164 | 0.3785 | -1.2511 |
| Mota-Engil | 2.32 | 1.90 | 2.08 | 4.07 | 1.17 | 0.6889 | 0.8280 | -0.4749 |
| NOS | 5.73 | 5.25 | 5.52 | 7.90 | 4.55 | 0.7482 | 0.9681 | 0.0671 |
| The Navigator Company | 3.71 | 3.60 | 3.64 | 5.99 | 2.42 | 0.6613 | 0.4591 | -0.0665 |

**Table 5 – Descriptive statistics (Non-ESG portfolio - Covid-19)**

| | Central tendency (in €) | | | Extreme values (in €) | | Dispertion | | |
|---|---|---|---|---|---|---|---|---|
| **Company** | **Mean** | **Mode** | **Median** | **Max** | **Min** | **σ** | **Skewness** | **Kurtosis** |
| Altri | 5.07 | 5.24 | 5.22 | 6.72 | 2.88 | 0.8227 | -0.3013 | -0.6016 |
| Banco Comercial Português | 0.13 | 0.12 | 0.12 | 0.21 | 0.07 | 0.0297 | 0.5456 | -0.0826 |
| Corticeira Amorim | 10.51 | 10.50 | 10.50 | 12.66 | 7.60 | 0.9126 | -0.5791 | 0.7223 |
| CTT Correios de Portugal | 3.35 | 2.60 | 2.92 | 5.38 | 1.91 | 1.0435 | 0.3807 | -1.4740 |
| Mota-Engil | 1.34 | 1.23 | 1.35 | 1.92 | 1.01 | 0.1662 | 0.7573 | 1.1423 |
| NOS | 3.35 | 3.39 | 3.33 | 4.98 | 2.71 | 0.4712 | 1.6072 | 2.8836 |
| The Navigator Company | 2.72 | 3.38 | 2.81 | 3.64 | 1.86 | 0.4440 | -0.0525 | -1.3177 |

Differently from the non-ESG portfolio, Tables 6 and 7 show that the price mean of the ESG portfolio during Covid-19 was higher for 4 companies, which also reached their higher maximum and minimum prices during the Covid-19 period. Interestingly, three of these companies are from the utility sector (electricity industry), despite the evidence from Zhong et al. (2020) suggesting that the Covid-19 led to systematic price decreases in this industry due to lower demand. That could have happen due to the higher attention given to ESG during the pandemic (Garel and Petit-Romec, 2021).

**Table 6 – Descriptive statistics (ESG portfolio - normal condition)**

| | Central tendency (in €) | | | Extreme values (in €) | | Dispertion | | |
|---|---|---|---|---|---|---|---|---|
| **Company** | **Mean** | **Mode** | **Median** | **Max** | **Min** | **σ** | **Skewness** | **Kurtosis** |
| Energias de Portugal (EDP) | 3.18 | 3.37 | 3.16 | 3.90 | 2.57 | 0.2609 | 0.1529 | -0.7252 |
| EDP Renováveis | 7.37 | 6.99 | 6.99 | 10.50 | 5.30 | 1.1752 | 0.7938 | -0.2744 |
| Galp Energia | 13.50 | 14.40 | 13.91 | 18.23 | 8.06 | 2.2532 | -0.2515 | -0.7019 |
| Jerónimo Martins | 14.02 | 12.84 | 14.20 | 18.07 | 7.70 | 1.9954 | -0.2334 | -0.3824 |
| Redes Energéticas Nacionais | 1.74 | 2.02 | 1.74 | 2.23 | 1.30 | 0.1802 | 0.4125 | -0.1315 |
| Semapa | 14.19 | 12.70 | 13.24 | 24.20 | 9.66 | 2.9719 | 0.9765 | 0.4640 |
| Sonae | 0.98 | 0.92 | 0.95 | 1.49 | 0.63 | 0.1639 | 0.4104 | -0.0340 |

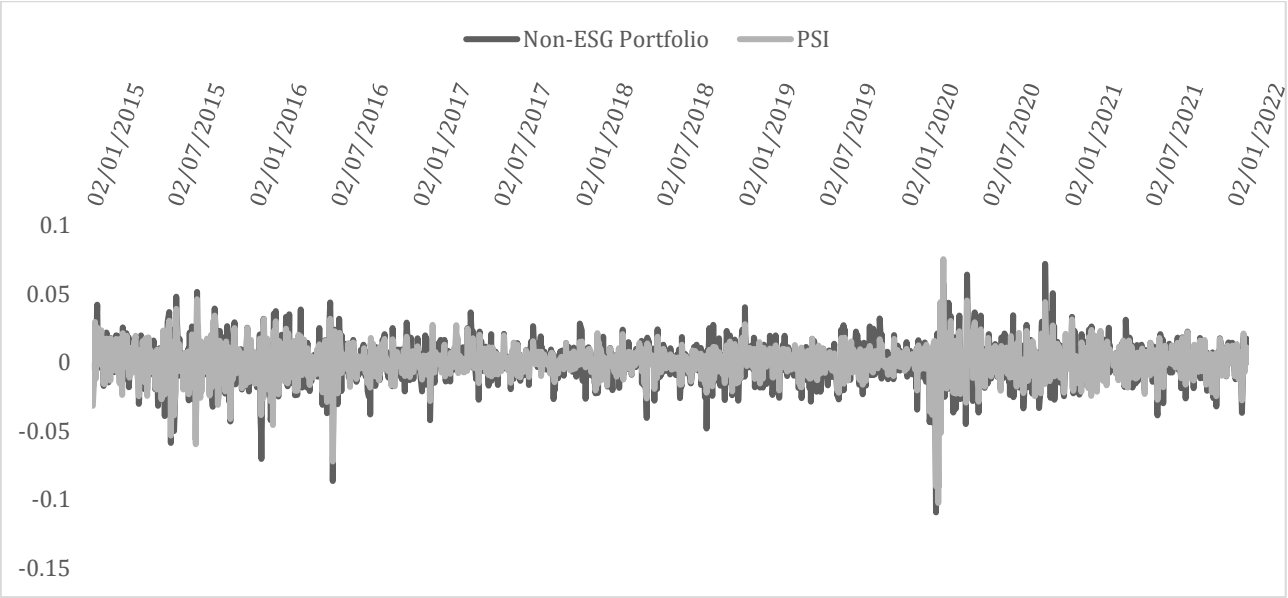
**Table 7 – Descriptive statistics (ESG portfolio under Covid-19)**

| | Central tendency (in €) | | | Extreme values (in €) | | Dispertion | | |
|---|---|---|---|---|---|---|---|---|
| **Company** | **Mean** | **Mode** | **Median** | **Max** | **Min** | **σ** | **Skewness** | **Kurtosis** |
| Energias de Portugal (EDP) | 4.50 | 4.71 | 4.53 | 5.63 | 3.00 | 0.4185 | -0.5680 | 0.9137 |
| EDP Renováveis | 17.30 | 10.42 | 18.31 | 25.80 | 8.89 | 4.3145 | -0.2040 | -1.2685 |
| Galp Energia | 9.90 | 8.65 | 9.58 | 16.03 | 6.94 | 1.6458 | 1.8269 | 3.5583 |
| Jerónimo Martins | 15.91 | 15.53 | 15.45 | 21.87 | 12.65 | 2.1745 | 0.9211 | -0.0819 |
| Redes Energéticas Nacionais | 2.13 | 2.10 | 2.11 | 2.47 | 1.57 | 0.1495 | -0.2238 | 0.8968 |
| Semapa | 10.31 | 11.70 | 11.50 | 13.86 | 6.44 | 1.9207 | -0.2792 | -1.4533 |
| Sonae | 0.76 | 0.66 | 0.73 | 1.07 | 0.49 | 0.1406 | 0.2716 | -0.9757 |

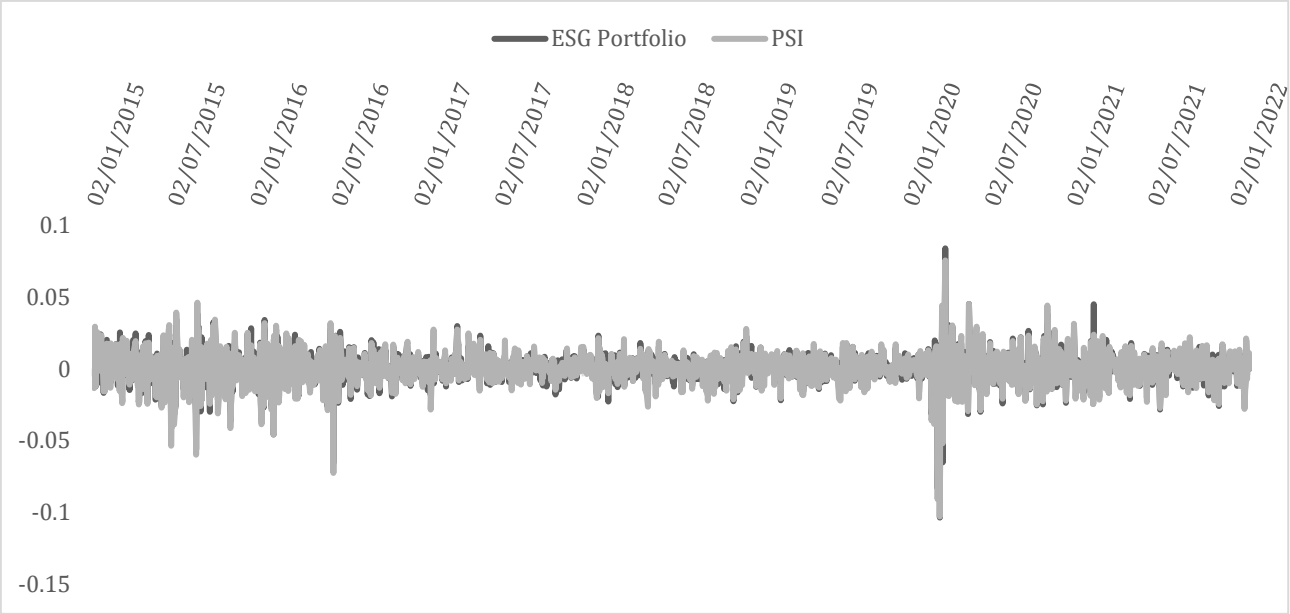
Both ESG and Non-ESG portfolios showed outliers with higher kurtosis in both period. The peaked distribution of prices shows tails towards the mean and contributes to higher volatility, potentializing the presence of herding in the market (Christie & Huang, 1995; Leite et al, 2018). This is specifically the case of Galp and Nos that had the highest kurtosis of their respective portfolios, both during Covid-19 period.

After initial calculations based on formula (1), Graph 1 and Graph 2 show returns of Non-ESG and ESG portfolios compared to the index over the observed period. The beginning of the observation period and the beginning of the Covid-19 period showed higher volatility, which could potentialize herding behavior for both periods (Lekovic, 2020; Spyrou, 2013). As the ESG portfolio returns seem to better mimic market returns, this portfolio seems to be more propense to herding that the non-ESG portfolio, as investors are more commonly following market directions (Christie & Huang, 1995; Chang et al., 2000).

**Graph 1 – Return of Non-ESG portfolio vs. PSI**



**Graph 2 – Return of ESG portfolio vs. PSI**




## 4.2 Multicollinearity Analysis

### 4.2.1 Matrix of correlation

Table 8 illustrates the extent and direction of the relationship between the variables of each of the regressions performed by this study (Cohen, 1988).

**Table 8 – Matrix of Correlation**

**Non-ESG portfolio under normal condition**

| | CSSD | U | L | | CSAD | Rm | \|Rm\| | Rm² |
|---|---|---|---|---|---|---|---|---|
| **CSSD** | 1.0000 | | | **CSAD** | 1.000 | | | |
| **U** | 0.1613*** | 1.0000 | | **Rm** | -0.0539* | 1.000 | | |
| **L** | 0.1930*** | -0.0523* | 1.0000 | **\|Rm\|** | 0.3929*** | -0.1238*** | 1.0000 | |
| | | | | **Rm²** | 0.3405*** | -0.2276*** | 0.8648*** | 1.0000 |

**Non-ESG portfolio under Covid-19**

| | CSSD | U | L | | CSAD | Rm | \|Rm\| | Rm² |
|---|---|---|---|---|---|---|---|---|
| **CSSD** | 1.0000 | | | **CSAD** | 1.000 | | | |
| **U** | 0.2234*** | 1.0000 | | **Rm** | -0.0148* | 1.000 | | |
| **L** | 0.1454*** | -0.0510* | 1.0000 | **\|Rm\|** | 0.4352*** | -0.2199*** | 1.0000 | |
| | | | | **Rm²** | 0.3443*** | -0.3197*** | 0.8493*** | 1.0000 |

**ESG portfolio under normal condition**

| | CSSD | U | L | | CSAD | Rm | \|Rm\| | Rm² |
|---|---|---|---|---|---|---|---|---|
| **CSSD** | 1.0000 | | | **CSAD** | 1.000 | | | |
| **U** | 0.1418*** | 1.0000 | | **Rm** | -0.0464* | 1.000 | | |
| **L** | 0.2012*** | -0.0523* | 1.0000 | **\|Rm\|** | 0.3765*** | -0.1238*** | 1.0000 | |
| | | | | **Rm²** | 0.3384*** | -0.2276*** | 0.8648*** | 1.0000 |

**ESG portfolio under Covid-19**

| | CSSD | U | L | | CSAD | Rm | \|Rm\| | Rm² |
|---|---|---|---|---|---|---|---|---|
| **CSSD** | 1.0000 | | | **CSAD** | 1.000 | | | |
| **U** | 0.3142*** | 1.0000 | | **Rm** | -0.0119* | 1.000 | | |
| **L** | 0.2154*** | -0.0510* | 1.0000 | **\|Rm\|** | 0.4805*** | -0.2199*** | 1.0000 | |
| | | | | **Rm²** | 0.3417*** | -0.3197*** | 0.8493*** | 1.0000 |

**, **, and *** correspond to a significance level of 10%, 5%, and 1%, respectively.*

In terms of direction of correlation: (i) dependable variables CSSD are positively correlated with independent variables Us and Ls at significance level of 1%, while independent variables are negatively correlated at 10% significance level; (ii) dependable variables CSAD are negatively related to Rm at 10% significance level, and positively related to |Rm| and Rm² at 1% significance level.

When it comes to the strength of correlation: (i) CSSD models present weak correlation among variables, with the exception of the ESG portfolio under Covid-19 that showed a moderate correlation between CSSD and U; (ii) CSAD models showed that |Rm| and Rm² have moderate correlation with the dependable variable and strong correlation with each other (Cohen, 1988). Although not ideal, such correlation is tolerable and accepted by the model of Chang et al. (2000) and Chiang and Zheng (2010) that relies on return of the market as base for all variables of the regression.

### 4.2.2 Variance Inflation Factors (VIF)

To supplement findings obtained from the correlation matrix and to address any potential issues of multicollinearity among the independent variables, a VIF test was conducted following the formula below (Williams, 2015):

$$(9)\ VIFi = \left(\frac{1}{1 - Ri^2}\right)$$

According to Table 9, it is evident that all VIF values are below 10, indicating that there are no issues of multicollinearity.

**Table 9 – VIF test**

| Portfolios under normal condition | | | | Portfolios under Covid-19 | | | |
|---|---|---|---|---|---|---|---|
| **CSSD** | **VIF** | **CSAD** | **VIF** | **CSSD** | **VIF** | **CSAD** | **VIF** |
| **U** | 1.00 | **Rm** | 1.08 | **U** | 1.00 | **Rm** | 1.13 |
| **L** | 1.00 | **\|Rm\|** | 4.06 | **L** | 1.00 | **\|Rm\|** | 3.63 |
| | | **$Rm^2$** | 4.21 | | | **$Rm^2$** | 3.84 |

## 4.3 Main Results

In order to test the hypotheses of this study and find if there is evidence of herding in the Portuguese market, eight OLS regressions are run to analyze the period specificities and the ESG factor. The outcome of the CSSD regressions are expressed in Table 10 and of the CSAD regressions in Table 11.

**Table 10 – CSSD OLS Regressions**

| | Non-ESG Portfolio | | ESG portfolio | |
|---|---|---|---|---|
| | **´Normal condition´** | **Covid-19 period** | **´Normal condition´** | **Covid-19 period** |
| **U** | 0.0071*** | 0.01033*** | 0.0035*** | 0.0119*** |
| | (6.34) | (5.55) | (5.63) | (8.16) |
| **L** | 0.0083*** | 0.0070*** | 0.0048*** | 0.0085*** |
| | (7.45) | (3.77) | (7.71) | (5.81) |
| **Constant** | 0.1621*** | 0.1637*** | 0.0001*** | 0.1354*** |
| | (63.64) | (38.90) | (77.77) | (40.97) |
| **F-statistics** | 45.53*** | 21.47*** | 43.37*** | 47.91*** |
| **R-squared** | 0.0667 | 0.0745 | 0.0837 | 0.1524 |
| **Number of observations** | 1277 | 536 | 1277 | 536 |

**, **, and *** correspond to a significance level of 10%, 5%, and 1%, respectively. T-test in between parenthesis.*

**Table 11 – CSAD OLS Regressions**

| | Non-ESG Portfolio | | ESG portfolio | |
|---|---|---|---|---|
| | **´Normal condition´** | **Covid-19 period** | **´Normal condition´** | **Covid-19 period** |
| **Rm** | -0.0027 | 0.0338* | 0.0023 | 0.0287* |
| | (-0.19) | (1.88) | (0.25) | (1.76) |
| **\|Rm\|** | 0.2994*** | 0.3003*** | 0.1630*** | 0.3799*** |

| | | | | |
|---|---|---|---|---|
| | (7.52) | (6.73) | (6.32) | (9.37) |
| **$Rm^2$** | 0.3719 | -0.4782* | 0.7143 | -1.1705*** |
| | (0.03) | (-1.95) | (1.02) | (-2.78) |
| **Constant** | 0.0085*** | 0.0097*** | 0.0073*** | 0.0076*** |
| | (39.06) | (24.67) | (45.15) | (21.37) |
| **F-statistics** | 77.30*** | 43.52*** | 70.47*** | 59.43*** |
| **R-squared** | 0.1541 | 0.1970 | 0.1424 | 0.2510 |
| **Number of observations** | 1277 | 536 | 1277 | 536 |

**, **, and *** correspond to a significance level of 10%, 5%, and 1%, respectively. T-test in between parenthesis.*

Based on the F-statistics resulted from the regressions, independent variables have impact on the dependent variable at a 1% significance level, which indicates that the considered models provide a better fit to the data than the model that only includes an intercept.

Cohen (1988) mention that R-squared values of around 0.1 or higher are considered acceptable for measuring behavior. Therefore, the found R-squared show that the proportion of the variance in the dependent variable that can be explained by the independent variables are within a reasonable range.

CSSD model regressions are positive and statistically significant at confidence level of 99% across all variables. This means that there is only a remote chance that that coefficients are positive by random chance, despite being close to zero. An outcome with positive coefficients indicates that investors´ behaved according to the EMH in the periods of up and down markets, which is an indication that there were no signs of herding in the Portuguese stock market (Christie & Huang, 1995).

CSAD model regressions show a contrasting scenario: (i) Under normal conditions, both regressions of Non-ESG and ESG portfolios resulted in positive $Rm^2$, which would indicate the non-presence of herding. However, results are not statistically significant, which means that the measured effect from $Rm^2$ into CSAD is weak or inconclusive, and the possibility of herding in the Portuguese

market under normal condition cannot be ruled out; (ii) Under Covid-19, both Non-ESG at 10% significance level and ESG portfolio at 1% significance level led to a negative $Rm^2$, an indication that there are signs of herding (Chang et al., 2000; Chiang & Zheng, 2010).

The different results for the presence of herding in the Portuguese stock market shown by CSSD and CSAD can be explained by the effectiveness of models. CSSD can only detect herding presence around market mean in extreme market movements (Christie & Huang, 1995). Meanwhile, CSAD models are capable to detect herding in less extreme market movements in addition to contemplate non-linear relations (Chang et al., 2000). Therefore, for the sake of hypotheses testing, results found by CSSD models are only taken in consideration in the scenarios which CSAD models had no statistical significance.

## 4.4 Discussion

According to the results, $H_1$ is rejected, as CSSD models showed no presence of herding in the Portuguese stock market under normal condition, and non-statistically significant results of the CSAD models cannot be used to validate results found by CSSD models (despite coefficients also turning positive). This finding contrasts with the theory of Leite et al. (2018), as the Portuguese stock market did not present signs of herding before Covid-19, despite its high susceptibility to herding even in more stable periods.

The higher tendency for having higher volatile periods as shown by Caiado (2004) was confirmed by Graph 1 and 2 in the beginning of the observation period, but volatility was insufficient to ignite the herding behavior under ´normal condition´ in the Portuguese stock market. These results are in line with the theories of Lekovic (2020) and Spyrou (2013) that suggest that with less

uncertainty in markets, herding also becomes less evident, and as consequence, contrasting with the theory from Hwang and Salmon (2004).

$H_2$ is accepted because CSAD models bring statistical evidence to suggest that the Portuguese stock market experienced herding phenomenon during the Covid-19. This finding is in accordance to Baek et al., (2020), as the Covid-19 period brought higher volatility to the Portuguese stock market, which had its highest variance at the beginning of the Covid-19 outbreak. Thus, evidence of herding in the high volatile scenario imposed by the Covid-19 also concurs with the theories of Lekovic (2020) and Spyrou (2013) and is in line with the results of Leite et al. (2018) and Kallinterakis and Ferreira (2006) that found significant signs of herding in the Portuguese stock market during other periods of market stress.

The presence of herding found by this study is compliant with the observation in the UK and U.S. stock markets by Ampofo et al. (2023), despite these being considerably larger and more liquid markets: no herding before Covid-19, while significant signs of herding during Covid-19. Therefore, this study validates the generalized results found by Kizys et al. (2021), as the Portuguese market was individually observed and still led to the same conclusion that herding was present during Covid-19.

A new observation country was added to the conclusions of Rubesam and Júnior (2022) and balances the limited evidence of herding found by the authors using worldwide data during Covid-19. Moreover, in combination with the results for the Italian market found by the last mentioned authors, through finding herding signs in the Portuguese market during Covid-19, there is a sparce indication of the correlation for herding found by Economou et al. (2011).

Lastly, $H_3$ is also accepted as CSAD models show that the deviation of individual stocks returns converge with higher intensity to the market mean, in other words, herding behavior is more evident in better ESG stocks. By finding a lower coefficient for $Rm^2$ in the ESG portfolio during Covid-19 if compared to Non-ESG portfolio, results show that ESG is an influencer to investors´ behavior, which contrasts with the evidence of Chan and Milne (1999), Rosen et al. (1991) and Rooh and Hussain (2022), while confirming the theories of Bénabou and Tirole (2010), Starks (2009) and Webley et al. (2001). Moreover, the Covid-19 seems to have enhanced interest in ESG, which is in line with evidence found by Garel and Petit-Romec (2021).

The fact that the ESG portfolio led to more herding than the Non-ESG portfolio is in line with Lee et al. (2021), as ESG factors seem to have played a role to increase herding. Moreover, there is suggestion that the Portuguese stock market might have sought remediation of the Covid-19 consequences through ESG, as theorized by García-Sánches and García-Sánches (2020).

As the presence of herding was not found in the ESG portfolio under normal condition and found in the non-ESG portfolio under Covid-19, results indicate that ESG might not be able to spark herding by itself and only surged as a consequence of the Covid-19. This finding might be used to strengthen evidences brought by Rubbaniy et al. (2021), as investors might have suppressed their own beliefs to focus on ESG due to the consequences of the Covid-19. In addition, results bring a new perspective for the studies of Ciciretti et al (2021) who did not consider the possibility of concomitant herding in non-ESG stocks, due to specificities brought by the Covid-19.

# Chapter 5
# Conclusion

## 5.1 Conclusions

This study showed that investors in the Portuguese stock market are susceptible to follow others´ decisions through rational or irrational herding. Many factors could have led to this behavior, such as incomplete or misleading information, biases and heuristics or the simple desire to comply with the crowd for the believed benefits to do so. However, it is evident that investors can take a more deliberate and systematic approach to decision-making in order to avoid falling in the pitfalls of this behavior. For example, by herding, investors can have significant losses at individual level and cause systemic risks to the broader financial system by forming bubbles and creating market inefficiencies (Lux, 1995).

Empirical evidence revealed that Portuguese investors herded during the Covid-19, when investments in the Portuguese stock market were dispersed around the mean, in such manner, investors no longer evaluated each stock individually by their risk-return, but simply followed market direction (Christie & Huang, 1995; Chang et al., 2000). This means that the behavioral phenomena are capable to explain pricing in stock markets, and highlight the importance of Charles and Kasilingam (2016), Hirshleifer (2015), Shiller (2003), Thaler (1999) among other prominent studies in the field of behavioral finance. Furthermore, the detection of herding raises doubts on the appropriateness of the assumptions of the EMH from Fama (1970), as in accordance to Malkiel (2003), price mismatches surge when investors no longer take optimal decisions, giving the possibility of reaching superior profit without additional risk.

In line with Lekovic (2020) and Spyrou (2013), Leite et al. (2018) and Kallinterakis and Ferreira (2006) evidenced that there are signs of herding in the

Portuguese stock market during market stress periods with higher uncertainty and volatility, which seems to be the case during the turmoil caused by Covid-19. Despite the higher volatility that the Portuguese stock market shows in comparison to larger markets and Portuguese investors´ predisposition to herd, no signs of herding was found before the influences of Covid-19 (Caiado, 2004; Leite et al., 2018)

Noting the higher attention given to ESG, Portuguese investors showed to be more tendentious to herd towards the stocks with better ESG performance in line with results found in other markets (Braz et al., 2023; Carvalho, 2023; Gomes et al., 2015; Benz et al., 2020; Ciciretti et al., 2021; Rubbaniy et al., 2021). However, as both ESG and Non-ESG portfolios showed herding, ESG performance seems not to be the determinant factor for the occurrence of herding in the Portuguese stock market. Instead, higher herding to ESG stocks during Covid-19 could be a reflection of the phenomenon observed by García-Sánches & García-Sánches (2020): an extra influential to invest in ESG in order to alleviate the consequences of the pandemic crisis.

As this research brings new understanding for how Portuguese investors behaved under Covid-19 and ESG aspects, it opens a scope of herding that can be similarly analyzed by other researches in different markets based on their particular characteristics. As such, academia can advance theorical models to better identify herding behavior under the ESG characteristics, develop new empirical studies around the reasons for herding in the Portuguese stock market and advance interdisciplinary studies as the herding phenomenon includes phycological and social aspects.

## 5.2 Implications of this study

The CMVM can use this study as base to (i) monitor systematic risks to take appropriate actions to mitigate them; (ii) encourage sustainable investments by

standardizing ESG disclosures; (iii) discourage schemes that stimulate the herd; (iv) enhance market efficiency by promoting greater transparency, disclosure and competition among market participants; (v) develop regulations around crisis periods and ESG reporting. For example, CMVM can anticipate that periods of uncertainty, like the Covid-19 period, will foment presence of herding and prearrange measures to ensure stability during these periods. Another example, knowing that investors tend to herd more towards ESG investments, CMVM can create standard templates for ESG reporting or stipulate minimum ESG requirements for allowing stocks to be traded in the Portuguese stock market, which would increase competitiveness and match ESG performances, consequently discouraging herding.

Implications fall upon investors that are better informed to identify opportunities and avoid potential risks. On one hand, by knowing that herds agglomerate during situations like the Covid-19 and that stocks with better ESG attract the herd, investors can create strategies to benefit from market mispricing. For example, by buying/holding ESG stocks in the beginning of more volatile periods, as the demand will potentially increase by the effects of the herd, and making sure to sell these stocks in the short-term as market prices can suddenly drop for stabilization. On the other hand, by being aware of such behavior, investors can also avoid potential risks by diversifying their portfolios and reducing their exposure. For example, by not having more than half of their investments in ESG stocks (as these experience higher herding), or by simply decreasing their exposure in higher volatile periods to avoid potential downfalls of herding.

Knowing that this behavior is more evident in stocks with better ESG, companies can create new framework to improve their ESG performance and reporting in order to benefit from investment agglomerations. Additionally, companies can use the insights from a study to develop strategies that increase

their resilience to market volatility, such as diversifying their investor base, improving transparency, and developing contingency plans for different scenarios. Above all, knowing the implications of herding, companies can provide transparent information and build up trust with stakeholders which can generate value for fostering investor relations and reducing the impact of herding behavior.

## 5.3 Limitations of the research

By taking advantage of the CSSD and CSAD models, this study facilitates replication and is compliant with two of the most prominent procedures to find herding. However, these models also bring some limitation when it comes to individually analyzing specific characteristics of stocks, therefore, herding was observed in participants of PSI solely dividing by their ESG performance. This led to the possibility that other explanatory factors, additional to ESG, might have impacted behavior for each stock.

As PSI components have been shirking along the years. Due to the limited number of current companies, by adding or subtracting participants, results might considerably differ as there can be a high influence in market returns. Furthermore, intending to only focus on a stable period and under the influences of Covid-19, this study limited the observation sample, and observations on a longer time horizon might show market trends and detect herding behavior that require a longer time horizon to be evidenced.

## 5.4 Future Investigation

Studies can deepen in the reason for why Portuguese investors herded during Covid-19 to better analyze if this was caused by rational decisions or simply by irrational reactions. Furthermore, each stock can be individually analyzed to measure the impact that ESG factors had in investment decisions, as other

characteristics of the stocks with better ESG performance might be adding to the reasons why investors showed higher herding around the ESG portfolio.

As cultural and market factors can influence people's decision-making and behavior, observing herding during the stable and Covid-19 periods in alternate markets might lead to alternate results. As such, new researches can be conducted to see if this was a global trend and if the herd, in different countries, also agglomerate around ESG performance.

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