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Chair of Managerial Decision Making

Behavioral Finance and the role of emotions in investment decision making: An experimental approach

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Acknowledgments

"No man is an island" Cit. John Donne

Da questa citazione voglio esprimere la mia gratitudine verso coloro che mi hanno permesso di essere qui oggi,

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Introduction

I've always been fascinated, and I've actively operated in the financial market since I've started the university. I wanted to redact a paper which enabled me to deep dive in the passion that I have and I wanted to give a contribution to the observations that I've made in the market dealing with the lack of responses that the commonly sharable instruments showed me. As the time went by, I've understood that the way of operating faces numerous constraints related to the emotivity, and so I decided to base my thesis over those limitations affecting the decision-making process.

This work has been performed in order to analyze the principal theories of Managerial decision making and Behavioral finance for gaining an insight toward the role of emotions in investors.

The world of investments has been characterized from basing its reasoning toward an assumption of rational agents, pursuing the highest return, with the minimum risk, without any emotional constraint.

The advent of Behavioral Finance, which has incorporated psychology into investment decision making, has enabled to link the constraints of human reasoning with the theoretical assumptions of Finance. The merger between those two has given answers to a huge number of facts which were remained unexplained due to the lack of congruence between the theory and reality, such as shocks and trends in financial markets.

In fact, those events are elicited from the presence of some main cognitive biases, classified as Herd Behavior, Overconfidence and Self-attribution, which brings investors to follow in a common way paths and patterns, misestimating the effects of things in positive or negative terms.

Going through the analysis, I've dealt with the main theories of evaluation of investments going through the Capm and the Multiples models of evaluations in order to deeply analyze the reasoning which has given the birth to these rational theories and which have found the financial world.

This dichotomy has brought to the contrast of two kinds of agents, called Informed traders and Noise ones; the former are characterized by behaving in accordance with the rationality assumptions, without incurring in biases and taking advantage of the latter ones, which show biases in their reasoning following the shortcuts and mental clusters described by the Behavioral finance.

After dealing with the rudiment of those theories, I'll focus my researches over the Herd behavior in financial markets, being a popular bias, which creates a common reasoning of noise traders applying a copying strategy. In fact, agents following this reasoning are brought to act as herds in order to try to get maximum results with the lowest return. The main theory analyzed in this topic is the Bayesian's one, which gives an explication through a mathematical theorem to the existence of information-based Herd behavior. It supposes that after a certain number of confirmatory facts, agents tend just to follow what has been done to their previous players, falling in a trap of isomorphism which brings everyone to behave in the same trend.

The Bayesian theorem has explained an irreversible fact, saying that after a Cascade of same actions has born, it cannot be stopped.

In contrast to what the theorem have said, in the last chapter, I've created a game and conducted a pilot experiment in order to give a possible answer to the discrepancy between the theory and practice, following that herds at a certain point dissolve themselves. Taking as a starting point the Bayesian formula, has been created a game with an induced isomorphic behavior with an informative barrier, delimiting the connection points between actors. After the herd has been created, the information asymmetry is removed, and the situation will completely change.

The results will explain that, effectively, herding can be stopped through breaking the information asymmetry between agents, in fact, being able to process a higher number of variables and looking for the diversity of opinions, will give an unbiased base in order to pursue the right choice.

The experiment has had a double functionality; firstly, it has tested the effectiveness of the Bayesian game through the first question posed in the survey and secondly it has validated the hypothesis of the pilot experiment, drafted as following: "Information asymmetry affects the Information based Herd behavior".

Cap 1: Investments and methodologies of evaluation: Rational vs Emotional theories

One of the main aspects founding our capitalistic society is related to the fact that people pursue their wellness through investments.

An investment can be classified as "The productive use of savings, that is, the increase or maintenance of the capital stock over a given period of time".

The financial market is a risk adverse place where professional and non-professional investors meet each other, and they bet over the pre agreed value of a huge number of securities.

During time we found that very numerous theories have focused on understanding what its right (Rational) and what its wrong (Irrational) in determining the actions that people do.

In this thesis I will focus on the main theories and aspects that characterize an irrational player and I will classify and test one of these aspects through the game theory.

The canonical theories of Finance have focused on trying to understand the exact price or the target price (TP) of many firms through the Capm model, explained in this way: $ERi=Rf+\beta i$ (ERm-Rf); affirming that the Actual value of a security is related to the cashflow generated discounted at today's time.

So, the price of an instrument should reflect clearly the level of projected cashflows.

But as we know the price of financial instruments are very different sometimes from the price targets assigned by analysts and this is a very tough problem to be addressed.

Even if we have strong evaluation methodologies such as the Capm formula and the Multiple analysis, we find that this mismatch of prices cannot be explained through the mere "Rational" aspect of these theories.

Upon these constraints in the last decades has born a new redefined Sub theory, under the Halo of the Finance: The Behavioral Finance.

"Behavioral finance deals with the study of investor's psychology and its role in making financial decisions". (Kapoor, Prosad, 2017)

This field relaxes the assumption of rationality present in standard finance theories and explains that real investors are influenced by their psychological biases. These ones get translated into their behavior due to which they can take suboptimal decisions. (Kapoor, Prosad, 2017)

In the market we can see two main different kind of traders; the "Information" ones and the "Noise" ones (Shefrin and Statman 1994), mainly characterized by some peculiar aspects: The information traders are not as noise traders characterized by cognitive mistakes and behavioral biases.

These kinds of traders have also other definitions attributed; for example, "Noise traders" or "Liquidity traders" are the names given to those ones who lose money, on average, when they trade. (Dow, Gorton, 2006);

But also, they are recognized as "Investors who make decisions regarding buy and sell trades in securities markets without the support of professional advice or advanced fundamental or technical analysis." (Source: Investopedia)

According to the Ree literature, we assume that investors maximize their utility with rational beliefs, where this kind of perfect beliefs are related to the consistency with the model.

Inside this model we have the concept of "Noise", but it is explained in vague terms corresponding to a certain random error. (Dow, Gorton, 2006)

According to (Kyle 1985) we have informed traders exploiting the information in a rational way, but the market is populated by noise traders which act without using information and so they behave randomly. (Dow, Gorton, 2006)

One major way of thinking classify noise traders as agents acting with Behavioral biases; for example Shleifer and Summers (1990) said: "Some investors are not fully rational and their demand for assets is affected by their beliefs or sentiments that are not fully justified by fundamental news" (Dow, Gorton, 2006)

According to this theory investors follow some kind of heuristically "Popular models" to create and base their decisions on investments.

In this case I would analyze the behavioral error which noise traders incur.

In the search of the "Rational truth" I can hazard by saying: "A buyer of an asset is prepared to pay a seller a price p only if the buyer believes that conditional on the seller agreeing to sell the asset, the value of the asset exceeds p. But, then the seller, knowing this, is at least as well off keeping the asset. So, no one trades." (Dow, Gorton, 2006)

The discussion upon Rational and Irrational is a huge field that I would like to analyze in order to find a new game, in order to discuss the eternal "Fight" between these major theories in investing decisions. I would like to construct a game in a controlled laboratory experiment in order to test one specific kind of behavioral bias through a business game.

In these specific cases I found some peculiar literatures that allowed me to come up with the following possible hypothesis:

H1: Information asymmetry overcoming affects the Information based Herd behavior.

Keywords: Behavioral finance; Market efficiency; Emotions and investments; Noise traders, Market sentiment; Herd behavior; Market efficiency; CAPM; Managerial decision making.

1.1. Investments and why do people invest? Why to evaluate?

Since the beginning of the society people begun not to consume part of the grain and wheat that they were able to produce in order to stock it and to be able to use it in "Lean" periods caused by unfavorable events.

The "Savings" made in moments of overproduction were necessary in order to survive when these ones have occurred.

Mainly farmers weren't able to sell their own grain and so they partly destinated this part of it to them and their relatives for the next future.

When the society moved on and the overabundance of food has become a recurrent factor, farmers begun to sell portions of it to the people living in towns.

The exchange of food initially was collateralized through things using the "Barter", but the necessity of a common exchanger determined the introduction of money.

Under this condition has born the first kind of market, were farmers begun to sell the exceedance of their harvest to citizens and people started to begin new typology of works, becoming artisans, manufacturers, lawyers etc.

Even if a lot of time has passed since those times, the farmers as of today exploited a simple rule that still now a days is moving our world, the demand and offer one.

In the markets they were selling their products to the best bidder according to the demand of citizens and to the offer of the countries.

Under this reasoning has begun the accumulation of common exchange tools (money, gold, bronze) which enabled people to accumulate a not perishable capital.

This capital was required to buy, and it was commonly accepted, so the farmers started to focus on their jobs and begun to acquire all the stuffs that they were used to produce at home, such as clothes, ceramics, fabrics and so on.

This process enabled farmers to boost their productivity, focusing more on their specific jobs, and so the overproduction of wheat begun to become an overproduction of money. (Siandra, 1990)

The "Capital" enabled people to buy machines and instruments to perform better their activities; Now, for becoming a farmer they weren't as competitive as the other ones which had instruments to work on their fields, so the new farmers had to find a way to buy the machines necessary for their jobs and by doing so has born a demand for the "Excessive capital" of those richer countrymen.

Under this condition has born the modern concept of investment, mainly sacrificing a part of the income in order to create a cashflow in the future from that "Frozen" capital.

The "Frozen" one begun to be lent to others, thanks to the demand for money, and people with huge possibilities begun to earn a profit called "Interest" over that lent capital;

By doing so they enabled others to build and to perform their jobs in a more efficient way and it allowed to create other wealthy people starting to lend their own capital.

The beginning of this circle between people needing to have money to work efficiently on their fields and people with excessive returns has created intermediaries able to match the demand and the offer.

As the time went by these ones have created the financial institutions such as banks and the financial markets, acting as giver of money taken from savers and allocating to the most efficient actors requiring them.

The role established from these new actors has taken the important role of selecting the best actors in the market through the assignment of capital to the most capable firms.

Based on this historical basis, we can try to give a more precise and actual definition of an investment, mainly referring at it as "The financial activity of an economic subject called investor, focused on incrementing its capital goods through the acquisition or creation of the economic resources, to be used in the productive process". (Hayes, 2021)

Through investments people try to exploit their own money in order to repay and to gain an interest over the capital that they have employed.

The employment of the capital can be made through several instruments such as securities, bonds, houses, raw materials and so on.

The possibilities of investing can be almost infinite, it's necessary to gain a required rate of return for the capital employed in something which is less liquid than cash.

The market pays off those who are willing to immobilize their excess capital, since there is an exchange from people which require capital and people who are disposed to lend their capital.

The tradeoff between these two counterparties enable to the most efficient players in lack of resources to be able to exploit their businesses, but also it gives an opportunity to those who detain the money, since they can earn a scalable return without performing physical work.

Under this new mechanism of performing the everyday activities, at that time, but up until today has arisen a question: "How do people assess the price necessary of a potential investment?" Even if this question can be very wide and can contain an infinite number of possible answers, in the next chapter I will focus on the mainly used and most accepted rules inside the financial market.

1.2. Valuation methodologies for the price of an investment

Trying to extrapolate the weight of an investment is necessary in order to create a common value sharable with other investors, which can be widely accepted and agreed upon.

Even if this process should be as most straightforward and commonly accepted as possible, during time have appeared hugely different valuation methodologies.

These ones can be applied to a very large audience of instruments, but for simplicity I will analyze those ones which are used in corporate investing.

The business evaluation techniques generally take into account some major values of companies, which are the profitability, the arrangement of the capital structure, the value of its activities and the forecasted earnings.

These ones rely upon the capital structure of the firm, divided into liabilities and risk capital, where the output of the former applied ones will give the enterprise value (EV) of the firm, while the latter, will show the equity price.

Having one of the two resulting output it's possible to get the value of the other applying this identity: EV – Liabilities = Capital risk value.

According to this reasoning we can classify some main methodologies of evaluation, bearing in mind that all of them should bring the same output applying the previously listed identity.

Asset-based valuation:

The Asset based valuation figures out the value of a firm through finding and aggregating the weights of the assets that compose it.

Following this methodology, the value of the equity can be extrapolated through the difference with the debt, having that Risk capital = Assets- Liabilities.

This one will get the value of a firm regardless of the forecasting of future possible changes, in fact the future cashflows are ignored and the value of the firm is estimated exclusively toward the available data in the sheets.

The deficit of this methodology is related to the fact that firms are estimated without the real value of the firm, in fact not counting on the continuous ability of creating earnings in the future. Through this reasoning the evaluations tend to underestimate the potential real value of a firm. The objective of these ones is to give a fair value of the assets accordingly to the market current prices.

The main methodologies following the asset-based theory are the Book value one and the Adjusted net asset one (Miciula, Kadlubek, Stepien, 2020)

They are also called "Cost-based" methodologies because the assets are valued over one way of thinking: which is the cost necessary to replace them? (i.e.: How much do I need now to rebuild this asset from zero?).

These kinds are used for valuing firms at the very early stages or firms with very difficult features to be evaluated.

These methodologies are quite straightforward at the appearance, but they present very wide difficulties in estimating the value of unique assets (ie. How much do I need to rebuild the brand of Coca Cola from the beginning?), where the value in the common market cannot be easily found or even cannot be found at all; moreover these deficits are relevant if we consider specific intangible assets such as the brand awareness, the goodwill and the knowledge economy.

The appraisal of those unique features should take into account of specific evaluation methodologies which embed thousands and thousands of factors, leading to strong doubts over the fairness of the price assigned.

Market based method:

According to the market-based methodologies, the value of a firm can be estimated through observing the value assigned by the market; in particular based on listed firms.

The assets can be estimated through comparable which already have a value, using a sort of "Copy and paste" methodologies of values (if a 1kg of iron is traded at 1,6 cents so my balance sheet that have blocks of iron weight 3 tons, will be valued x).

It takes into account and observes the value of similar transactions in the market. (Miciula, Kadlubek, Stepien, 2020)

According to this technique a very useful instrument and one of mostly common one is used: The multiple analysis.

This methodology of analysis, in order to extrapolate the value of an unevaluable firm, takes from the market some comparable ones; for example, from the same industrial sector, or same characteristics and compares some specific ratios in order to get the value of it.

The ratios taken into account are generally standard ones, which can be easily explicated and most of all commonly shared with the economic world.

They are: P/B ratio or Price to book ratio, P/E ratio or Price over earnings ratio, P/S ratio or price to sales ratio; P/Ebitda ratio, Price/ Free cashflow ratio.

Beginning with the Price/Book it takes into account the price in the market of the shares, in this case the market capitalization of the firm, calculated as price per share times the number of shares in circulation, and the book value which is the value of equity on the balance sheet.

The market capitalization represents the value of the equity or the risk capital of the firm through the demand and offer law in the market.

The ratio between these two tries to understand the difference in estimation between the books and what the market expects.

A higher market capitalization shows an optimistic future of the firm, meaning that the investors expect that there will be positive earnings and positive cashflows, otherwise it will manifest the opposite.

Dealing with the Price/Earnings ratio, it takes into account the market capitalization of the firm over its earnings.

It's probably the most important one of these multiples because it shows the willingness to wait in order to repay the investment from shareholders, in other words, it shows the required yield for the investment.

Each industry is characterized by very different ratios, but between them, they show very import similarities, for example the automaker one shows it near 3, instead the fashion sector could also show it near 20.

Mainly all the analysts take into account of it, because it's the perfect thermometer of the business, stating if the firm is profitable and how much is more or less remunerative than the direct competitors.

The Price/Sales ratio is a much weaker one because it doesn't show you if the firm is bringing value added, even if it may be expressed in the price.

This one is quite marginal for giving a fair interpretation to a security price, but it can be useful in order to understand the range where the industry's firms' ratios are allocated, it should be used in conjunction with the previously listed ones.

The Price/Ebitda ratio can be applied in order to sum up the ability of the firm of producing real value added, this is because the earnings themselves can be manipulated bringing for some years higher and lower values thanks to some specific actions, for examples uplifting the depreciation of the inventory or selling some assets and having a higher capital gain.

Dealing with the Price/Free cashflow, it is useful in order to understand if the financial flux of money is working properly, meaning that the firm is really able to produce a cash inflow.

It is a measure of the solidity of the business and states the quality of the management, in fact it can differ strongly from firm to firm. (Saputro and Hartono, 2016)

The Fundamental analysis:

This kind of analysis is very used for determining the Price Target of a listed firm. It extrapolates the value of a business through the discounting of future cashflow to today's time, taking into account a discount rate extrapolated through the formula of Capm. The future cashflows used are generally the free cashflows, formatted as in the following formula:

Revenues - (Operating costs + taxes) - investments in operating capital=Free Cashflows

They are generally predicted through analysts; this is the most tricky and difficult assumption, because it presupposes to look in the future elaborating the data obtainable as of today: business outlook, macroeconomic factors, commodity prices and so on.

In order to get the value actualized today, these cashflows are brought at the present time through the compounded interest at the year zero.

Even if the process, that I'm going to explain, is quite straightforward there's a lot of margin through the value assigned to the future.

Under the "Halo" of this reasoning the main instruments used are the Residual earnings model (Rem) or the discounted cashflow model (DCF).

This two can be divided in two other main theories which is the Asset side valuation of the balance sheet and the equity side valuation; meaning that the Asset's one brings out the EV, or enterprise value of the firm, evaluating all the Assets of the firm.

The other one will directly give you the value of the equity, which is the value of the proprietary or the risk capital, which represents the market capitalization of listed firms.

Selecting of the two favorite methods, it's necessary to discount the future cashflows you have to use for the equity side for the RoE (return on equity) and for the Asset side with Wacc (Weighted average cost of capital).

The first one refers to the expected return only related and requested from the potential shareholders, the last one is the mix of the rates requested from the shareholders and the debt holders, representing the discount rate for the debt side and the equity side of the balance sheet.

Asset side methodology:

In order to analyze the assets of our firm we are going to use the DCF instrument; to get the value, we need to predict the unlevered free-cashflow and to discount them through the Wacc formula:

WACC = Ke x (E/D+E) + Kd (1-t) x (D/D+E)

Where the Ke is the cost if equity, the Kd is the cost of debt and E is the portion of equity and D the portion of debt, through this passage we get the total average cost of capital and then we can proceed through the DCF method to get the value of the assets:

 \sum FCFt/(1+WACC)^t + TV/(1+WACC)^t

All the variables showed in this formula have been already explained previously, but I need to talk about the TV or terminal value; in fact it represents the potential and so estimated value of the firm in the future through the perpetuity, meaning that from a certain year in the future the cashflows are estimated to be constant in time forever, with a certain fixed tax of growth, generally related to the expected inflation and so bringing them through the Wacc to the value today we get the potential resell price in the future of the firm.

Equity side methodology:

In order to analyze the value of our firm from the perspective of the risk capital, we need to take into account the following two models:

The first one is the Dividend deduction model: dividends are considered as future cash flows. They are envisaged according to the Gordon Growth Model.

In order to discount the cashflows, it uses as discount factor the cost of equity following the subsequent scheme:

 $\sum Dt / (1 + Ke)^{+} t + TV / (1 + Ke)^{+} t7$

The second one is the Residual profit model: The main thinking, as stated from the previously model, is related to the fact that we consider as future cashflows the residual incomes, which are going to be actualized using the cost of equity.

The value which comes out must be summed to the already present value of the firm, which is represented by the book value of the issued shares, so the formula representing this reasoning is the following:

Actual value = Base + future cashflow discounted

Where the Future cashflows stem from the residual earnings:

Intrinsic value=BVt0 + \sum RIt/(1+Ke)^t + TV/(1+Ke)^t

The BVt0 represents the balance sheet value of equity at today's time, acting as an anchor of the value, representing a starting point for the evaluation.

In addition, we need to take into account the future cashflows which must be discounted in order to gain a deep insight over the true "Intrinsic value".

This term shows the right price which a rational investor should be willing to pay in accordance with the amount of cashflows and the discount rate applied.

The residual income (RI) is an adjusted measure for profit, which stems from the net income, but it is net of equity times the cost of equity.

1.3. Errors and deficits of Capm and Multiples; the Behavioral technical analysis

The main argument of all these theoretical approaches is related to the theory of the "Perfectly rational player".

The Rational behavior analyzes the decision-making process that brings the consumer to the maximum level of satisfaction also referred as the optimal level of utility.

Rational behavior analysis generally begins with the premise that a subject, is maximizing its utility.

People which follows this reasoning are better off when they reach the biggest level of individual wellbeing, taking into account the rule that states "The more the better".

The Rational choice theory is backed by the rational behavior, and it is characterized by the fact that individuals are pursuing the best purchase possible, in order to maximize their utility function and getting the highest value possible.

This can be performed if the rational player is able to exploit all the information available in the market, so it can meticulously evaluate through a cost and benefit scheme which product is the best, getting the highest value of satisfaction.

In other words, "The Rational choice theory" states that buyers and sellers make decisions that best achieve their goals, taking into account all relevant factors beyond their control. The basic idea of rational choice theory is that people do what is best under the circumstances." (Green, 2002)

Following the surface of the theory we need to go in deep of it and the main axioms founding this reasoning are the followings:

1) The buyer has the possibility to choose between alternative products. (i.e. 1 or 2)

2) According to the completeness axiom, taking 2 products called 1 and 2, the actor can either prefer 1 to 2 or 2 to 1, or he can be unconcerned between the two.

3) Each set of possible choices are transitive, meaning that taking three products, if the agent is better off in choosing 1 to 2 and also better off in choosing 2 to 3, so it will be every time more satisfied by choosing 3 out of 1.

4) Our actor will pick the most preferred alternative, meaning that he will every time be better off in picking one of all the products in front of him (Green, 2002).

According to the theory of the perfectly rational player we need to distinguish between actors following the previously listed statements and others doing the exact opposite.

We refer to the first ones calling them arbitrageurs and the other ones as noise traders.

Even if the main reasoning behind these two kinds of agents or investors is well defined in the theory of perfectly rational players, in the literature we have various definitions of them.

The Arbitrageurs have various kinds of ways of being called, we can refer to them as "Rational Speculators" and also as "Smart money".

They base their forecasting of cashflows in a fully rational way, strictly maximizing their return and following the fundamental value of a security. (Shleifer and Summers 1990)

In the opposite side of the pie we find the so called "Noise traders" or "Liquidity traders", they are agents which are characterized by heuristics and biases that systematically affect their behavior, not following a straightforward and rational approach.

Mainly the role of Arbitrageurs is necessary in order to do one single specific thing: Bring the value of a security to its Fundamental value (Shleifer and Summers, 1990).

This principle is applied through the selection of possible portfolios, in fact when there are two equal portfolios in term of yields and the returns, the arbitrageurs will bring the price of these securities to be equalized, following the reasoning made, for example, in the DCF model.

Accordingly, when the market price of a bundle of stocks jumps over the price of the substitute portfolio, the rational investor will buy and sell the two products up until the prices are the same.

The irrational traders, as stated before, follow a set of recurrent biases which I'm going to analyze in detail in the next chapters.

The recurrence of common "Mistakes" creates some equal shifts in the demand and offer paradigm, following specific trends in the market; so, they are able to create a demand shift through their actions which affect the market.

It's important to underline that behaving "Randomly" trough their specific biases, some of them compensate the others; so, for example the actions of overconfident players will be blocked through over fearful ones.

The fact that these shifts are detectable, can be explained through saying that they tend to be isomorphic following some specific patterns; they repeat themselves in common mistakes based on signals, heuristics, popular models and recommendations of gurus. (Shleifer and Summers 1990)

These shifts in aggregate demand shapes the trends in the market, which create a common reasoning of them caused by this kind of irrational traders.



In fact, even if each investor performs in a different manner, through psychological experiments have been demonstrated that they tend to elaborate information in common mistakes and so they don't act randomly.

Taking into account this, according to (Alpert, Raiffa, 1982) actors tend to assume higher risks when they are biased by overconfidence, but also they follow the past patterns of graphs following the rule that "The history repeats itself" and they can ensue a specific movement creating bubbles. (Andreassen, Kraus, 1988).

According to (Tversky and Kahneman, 1982) has been proven that investors take more into account the news releases and they tend to ignore the interest rates movements.

Observing the market trends after the releases of ventures' new information and most of all the advisory of market gurus such as Jim Cramer, stock market tends to follow their suggestions during at least the day after the release.

This kind of experts, analysts and columnists, are able to bring the attention over specific acting firms, inflating the level of the volume exchanged and then consequently the price of the stocks. This phenomenon is typical of a noise trader, since when the light is brought over a specific firm, this doesn't affect the real fundamental value of this one.

Noise traders prefer to follow the hype of an announcement rather than relying on the rational methodologies previously listed: DCF, multiples and so on.

This "Emotional" flowing actors tend to rely on the so-called "Technical analysis".

This approach, born in the years after the second world war, started to be strongly applied from the seventy's up until today; it creates an increase or decrease in prices of securities without following the rational player's rules.

The technical analysis is the study of how price movements in a given financial market may help predict the future securities trends.

This technique has been developed in order to find with highest possibilities how the market react toward inputs; and so, this instrument is mainly used in order to reduce the uncertainty and to have a higher control over the flowing of investments.

The principal instruments used by Technical analysts is the Price chart, the Volume and the Oscillators.

Through the observation of the price movements in the graph, has been possible to delineate numerous techniques to predict future patterns.

In contrast to the Rationality theory, this methodology tries to understand the emotions of investors through resistances and supports, rather than looking to the balance sheets and income statements' book values.

The basis of the technical analysis has been created by Charles Dow.

It's thinking toward the study of the graph was backed by two fundamental statements:

1)The prices shown in the market reflect perfectly all the information available, so the market must be "Efficient".

2)Random charts changing can also be spotted in identifiable trends that are recurrent.

Since the discovery of Dow, nowadays there are some statements which are shared by Technical traders all around the world:

1)"The market discounts everything": this reasoning takes into account the fact that each fundamental factor is embedded in the securities price, but also all the information perceived in the market.

According to this view the technical analysis has a stronger perception of the market because it synthesizes not only the book value, but also the psychology of investors through the D&O

(demand and offer law) mechanism; it reflects the real value that investors are willing to pay in that moment, excluding the opinion of analysts using mostly the fundamental approach.

2)"Price moves in trends": the assumption behind this statement is that, even in presence of an unexpected movement, the price still follows a specific pattern that outlines its future movements.

Prices are assumed not to behave in countertendency of the previously established trends, the exchange of the past one condition is really rare.

In fact, as we can easily underline in the following graph, the prices once they started an uptrend or a downtrend, they don't change their circuit with news.

Only in presence of disruptive changes this happens, and it can bring to the inversion of the trend after breaking the resistances or supports.



Figure 2: S&P500 Font: Yahoo Finance, post crisis expansion and trendline

3)"History repeats itself": Technical traders believes that price movements since are created by humans, they tend to establish cyclical and repetitive patterns.

As the history of the world, also in security exchange we look at the past and try to find similarities for the future developments, creating our expectations and following our recurrent emotions: excitement and fear.

Even if some price charts movements are strongly aged in time, they are still used today since the human nature hasn't changed over decades (Murphy, 1999)

One of the main controversial aspect of the technical analysis theory is about buying when there has been already an uptrend, following a break toward a resistance, and to sell when the price has gone down, so following a specific pattern, rather than "Hoping" for a reversal.

These theories creating the technical analysis rely on observations of phenomena that haven't been previously proved, for example the phases of accumulation, distribution and liquidation of securities.

These axioms are explained through the fact that in the accumulation phase the prices remain steady on a resistance or slightly increase after a strong dropdown on the prices and biggest investors tend to buy in the "Deep" phase of the stock, while smaller investors tend to liquidate their positions.

The Distribution phase is mainly the opposite, when the security has seen a strong uptrend, the investors tend to liquidate their positions because they don't trust the market, or they are simply scared of the possibility of losing their earned money. (Chen, 2010)

1.4 Emotional value and its implications

Dealing with the critic to the rational standard theories of evaluation, it's necessary to have a hint to the Emotional value one.

This theory takes into account the non-monetary aspects of owning a specific good, usually applied to the ownership of a family firm.

In fact, this situation can be easily applied to those ones with a long story, or an outstanding brand, or of a strongly performing reputation, that even if in presence of bad book numbers, still the owner's willingness to accept the selling is extraordinary overvalued.

This situation can be easily reflected when there's a property on the market, in fact the owner of this one, if asked, will tend to pursue a price for selling which is higher than the one he will be disposed to pay if he wasn't owner.

This principle relates to the endowment effect of sellers, in fact their willingness to accept a price will often be higher than their willingness to sell if they wouldn't have been owners.

People tend to create a mismatch and they tend to consider objective things as part of their life and so the difference between the willingness to accept and willingness to buy can be reflected as the non-monetary benefit stemming from the emotional value of detaining an asset. (Kahneman, Knetsch, & Thaler, 1990).

The situation has brought numerous owners to follow emotional decisions which have usually led to tremendous results.

Even if the facts are clearly observable in the market, the causes stemming from this mismatch has various sources starting from two main phenomena, the "Possession attachment" and the "Endowment and willingness to accept".

The former phenomena can be explained as a one which is derived from the psychological control of an individual on something, it excludes the necessity of having a material right over the good.

This control which could be legally implemented or just psychological, will create an enrichment of the individual which owns this situation and so it represents a part of its personal universe.

The following situation can lead to the creation of a social identity with that good, in fact people tend to personify the objects that they own and so they consider them as part of their identity.

The way how the social interaction that a person has tend to be strongly affected by the achievements related to the firm that an agent has, and so there's a social status bias that gives a value to the link with that asset.

Moreover the existing literature have underlined that entrepreneurs owning a firm attach to their ones their essence through the incorporation of feelings, but also their objectives and self-references, due to this the mediation with this personal conflict of interests, it creates a situation mismatch which is hard to accept in emotional value. (Csikszentmihalyi & RochbergHalton, 1981).

Accordingly, the literature over the family firms presents other triggers in the non-financial value of an asset related to the firm's ecosystem.

This one, tend to comprehend kin and friends and so the acceptance toward a liquidation of a firm is enriched through numerous variables able to modify the interpersonal relations and other that goes beyond the mere economic valuation of the asset. (Dyer and Whetten, 2006).

The ownership of something can be explained also in affective terms, in fact, as humans we are brought to weigh gift from beloved people with higher values.

The existence of this dynamics enriches our essence, but it has not a sharable value on the market, showing a countersense over the common rational value of an asset.

A simple example is able to explicate these feelings: "Would you sell for its market value your engagement ring?", obviously at least 99% of respondents will say no.

In conclusion, the possession attachment of an object is biased from numerous and various factors which make for the owners the willingness to accept really expensive, being part of its spirit, its essence and its social status context.

Dealing with the literature of Endowment, Thaler (1980) found that people tend to underweight the things which are not in their possession in actual terms and they are less able to accept a fair price to things that they own.

This Endowment effect can be explained in the following way: "Occurs when an individual becomes attached to the good because he or she is often rewarded for doing so" (Knetsch & Sinden, 1984; Shogren et al., 1994).

This kind of earnings coming from the asset owned can be created from all the possible emotional stimulus coming from the external environment and these ones will affect the willingness to accept or "The minimum price acceptable" by the owner for selling the good. At this point we could give a formal structure based on the literature to the Emotional value:

Emotional value=WTA- Financial value- Private benefit of control.

In fact, it can be explained as the part of the WTA which is not related to rational expectations and so, which is not in line with the market sharable price. (Zellweger, Astrachan, 2007)

This mismatch can be calculated from deducting two rational measures, which are the financial benefits and the private benefit of control.

The former one refers to the real value of the equity, calculated following the standard rational evaluation methodologies such as Capm, multiples and so on.

The latter relates to the governance power which can be exercised by having a stake in the company, according to this, it can be easy to understand that the possibility of exercising an influence over a firm can bring higher personal economic benefits.



Figure 3: How feelings affect thoughts, font: (Deci, 1996)

The existence of an emotional value in investments, underline the existence of not only rational conditions of evaluations.

This situation should be incorporated inside esteems, in fact the intangible value of an asset generally creates hard to be understood deals.

Cap 2: Behavioral finance and its implications in financial markets

In "Aid" of this dichotomy between rational theories of evaluations and irrational perspective of values caused by noise traders, has born a new sub theory of Finance, the Behavioral Finance. Behavioral Finance it's a quite new academic thinking that merges the psychological theory with the classical rational theory of Finance.

It tries to give an apply to the common biases in the financial world, detecting their presence and calculating the possible impact toward the market.

It is very important because taking into account the emotions of investors, which are obviously human beings, allow policy makers to create laws and apply principles more realistic for the market.

Almost one hundred year ago, even without the presence of this branch of finance, Keynes as stated the following, underlining the existence of emotions flowing through the market: "The market is subject to waves of optimistic and pessimistic sentiment, which are unreasonable and yet more than legitimate when there is no solid basis for sensible calculations".

The main studied kinds of biases have been listed as following: Herd behavior, Self-attribution bias and overconfidence.

Starting from the Overconfidence, it can be referred as an underestimation of possible risks related to an asset, or an optimistic view, based on a bias created from a strong track record of the investor.

It refers to that kind of personalities that tend to rely too much on their presumed skills and thinking over-optimistically to their analysis.

The self-attribution bias can be expressed as the one of "Succesful" people, in fact actors following this one tend to attribute their luck to their personal abilities and when things go wrong, they heavy the inefficiencies of the others.

The former one, which I'm going to focus my study, refers to that kind of investors which tend to be "Trend followers" or as called from Dante Alighieri in the Divine Comedy "Sloths".

These psychological kinds of investors are strongly affected by their feelings, following the suggestions of analysts and most of all gurus, such as Elon musk or Jim Cramer and they tend to exclude their independent researches.

The aspect of human beings of creating herds can be observed clearly in all aspect of live, accordingly to "Stars", "Models", "Columnists" and "Politicians" but through some games in the next chapters I will try to give an answer in order to test why this happens.

2.1. The Classical financial theory and Behavioral Finance theory

The beginning of the Finance theory can be constructed through a series of "Must to be mentioned" events, starting from the 1800 as beginning point and going forward up to today. Going through this literature review I will cover chronologically the following theories:

The concept of "Homo Oeconomicus" by Mill
The Markovitz portfolio theory
The Efficient market hypothesis by Fama

One of the main concepts referred to the classical finance, is the expected utility theory.

Here this is translated as the measure of wellness of consumers, both private and public. (Kapoor, Prosad 2017).

During the first half of the 18th century, has been theorized the so-called Rational player or also called Homo Oeconomicus.

This character is strictly related to the utility theory, in fact its highest satisfaction is pursued when its utility is maximized, meaning that he obtains the maximum possible output given a certain budget constraint.

The founding characteristics of this homo are: Perfect rationality, self-interest and perfect information; these aspects are the milestones where has been built the traditional financial theory.

In order to create a perfectly rational behavior, the agent should be able to access to all the information necessary to create a critical reasoning and it should think egoistically following its only personal concerns.

We have to say that in the real economy these assumptions are pretty strong, most of all when we refer to the "Free information flow", in fact, institutional players and investors, can rely on major insights and this justifies the trend following of herds.

However (Barberis and Thaler, 2003) state that, in order to strictly follow the Homo Oeconomicus theory, is necessary that: actors are fully able to access information, but also, they must refresh their previously acquired stock of information; and additionally, they must maximize their satisfaction.

As the time goes by Markovitz, following the previous thinking, has theorized the fundament of one of the most important finance milestones: The Capm model. This mathematical model applies a simple relationship between the risk and return of a portfolio of securities.

It tries through the risk factor Beta, to understand the required return for investors; this risk one represents the level of volatility of the asset, related to the market trend.

According to (Sharpe, 1964) in order to estimate the required rate of return, an investor will look at the risk of the instrument which is buying (Beta), the return of the market, translated as the medium return of the stock market, and the risk-free rate.

The market return is quite important because it gives a benchmark in order to eliminate one main risk: The idiosyncratic risk or specific risk.

This is the one that we face when we have a portfolio of one single stock, so in this situation there's the possibility that even if the market performs quite well, the single firm can go bankrupt for any self-related reason.

In order to avoid the "Unpredictable" possible situation of a specific player is recommended to buy the market portfolio or a bundle of at least thirty different assets, in order to nullify this risk.

These mix of three factors create the simple but efficient formula of the required return through risk: $Ri = Rf + \beta i x (Rm-Rf)$.

The reasoning previously listed follows a straightforward approach which is able to give a perfect price to a security, applying the concepts of perfect rationality explained in the Homo Oeconomicus; but in the market through this approach, weren't explicated all the bubbles, the trends and the shocks that have been observed.

In fact, strictly applying this rule, all the data could have been collected in the market and so was necessary only to complete the variables to obtain the required return for the investment.

According to the last one of the theories previously listed, Fama has introduced the concept of Efficient market.

This one states that the prices showed in the market comprehend all the available information, representing the fair price attributable to the stocks.

Under this hypothesis, is impossible to get the extra return in stocks called "Alpha", because the only way to get a higher gain is possible through a higher risk.

So, the ability of the portfolio maker of picking undervalued stock is nullified and all the agents can get the same reward for the same risk.

The information in the market is perfect and available to all the agents creating the price through the demand and offer mechanism.

These three main thoughts have got numerous critics from the modern actual academics and in aid of the fallacy of these models, has born Behavioral Finance, which was trying through psychologists to incorporate the fallacy of human minds.

The progenitors of this new branch have been Kahneman and Tversky through their Prospect theory for analysis of decision making under risk (1979).

This new approach was not considering any more the rational utility function, but they replaced it through the value function.

These psychologists understood that all the losses and gains were different between individuals, in fact there were actors being more risk adverse and others being more conservative.

They were pointing the light on the "Value" perceived from the investors to their money, rather than attributing a standard one to all the actors.

Moreover, they were able to understand a strong assumption in Finance, which is that the pain of a loss is bigger than the satisfaction of an equal amount of gain, also known as Loss aversion.

As the time went by and the growing studies evolved, the Behavioral finance found the explications to another typical phenomenon in the market, the Momentum.

This one has been found observing that the movements of securities inside a range of half- full year, are able to predict the trend for the next years in the same direction (Jegadeesh, Titman, 1993).

According to this, the concept of market efficiency has been completely disrupted, in fact Eugene Fama stated that the markets reflects perfectly the intrinsic value estimated, while in this situation the truth has been demonstrated to be the exact opposite.

In order to conclude this Literature review, now having an overview of the evolution of the finance history, we express Behavioral Finance as the study of investors Psychology and the impact in applying their decision-making.

The fundaments of this theory don't exclude the previously discovered Finance, but instead it tries to weigh the rational based assumption which has been created and stating that the actors are effectively mentally biased.

These ones being facts affecting each person, impact over the decision making of everyone, leading them to take Sub-optimal solutions.

The existence of these errors, multiplied to all the investors creating the market prices, will give as output all the uptrends, downtrends and shocks of the market.

This is so important because, being able to recognize the deficit of human mind, can allow the legislator to weigh its decisions and to create rules in order to avoid all the economically disruptive events such as the 1929, the 2008 and so on.

At today's time, after the deep fall of the market during the coronavirus and then the extraordinary expansion of the stock exchange indexes all over the world, studying the aspects of human mentality in finance is a necessary condition for restoring a predictable path in the future.

Looking at the higher instability caused by the 2022's wars and the continuously growing feeling of an un-globalization of the world, for investing is necessary to introduce policies able to specifically deploy these inefficient behaviors, finding an outcome that doesn't bring evaluations too near or far from their real fundamental values.

Cap 2.2 Behavioral biases between common traders

Giving an answer to the deviation occurring in the demand and offer paradigm can be very tricky, in fact finding the possible hypothesis implies to look holistically at how people behave irrationally and why they do so. Through the psychological literatures, we can figure out a huge range of biases in the behavioral finance theory. (See Fischoff and Beyth 1975 or Thaler and Johnson in 1990).

The bibliography of the biases demonstrated under the umbrella of the Behavioral Finance theory are huge, but all of them are almost perfectly represented by the main ones which I'm going to present.

After the summary of literature review of Behavioral Finance, now I'm going to go through the deep of the main shared theories today.

In fact, according to (Zahera, Bansal, 2017) we can classify the majorly recognized biases in order to understand them and trying to deeply know the reasoning of each one.

As stated before, and going forward the already mentioned Overconfidence, Self-attribution bias and the Herd one, the academic research has found plenty of other biases which I'm going to deal with.

The existence of a huge and continuously updated literature is strictly related to the multitude of errors which human mind faces; and the progresses in psychology lead to new improvements in Behavioral Finance.

The disposition effect is one of those, it has been discovered by Shefrin and Statman (1985) and they were able to demonstrate that investors are brought to sell good performance securities earlier rather than those ones in loss, in fact an investor tend to maintain the open position in minus because investors prefer to defer the loss itself.

In other words, people tend to remain hanged to their open position burning money, rather than selling and trying to regain their bets.

This makes clear sense to the reiteration bias of human beings, being affected by the difficulty of accepting their mistakes, rather than recognizing their good qualities.

The existence of this error shows the incapability of accepting the mistakes made and it can be strongly disruptive for the investor and the market itself.

It can lead to continuously lower evaluated stocks which can difficultly regain their fair value since investors remain hanged on their positions, without moving the money to most efficient firms.

During the same year, there has been the discovery of the Mental accounting bias by Thaler. The concept of the theory can be explained through a simple statement: Is it equal for you to pay 1\$ of a coffee through cash or card?

Well now a days this fact can be more or less equal, but still now people think that it has a higher mental cost.

The mental accounting bias, states that people tend to divide the money and weigh them in different ways, money in the bank, money in the pocket, disrupting the rational assumption of the fungibility of money.

For some human reason, people prefer to spend their cash in the pocket, while they feel more pain in spending the same amount of money from the bank account.

The mental accounting bias can underline the potential lack of liquidity in the European centric financial markets, where people bring a higher emphasis on banks and they are less willing to use their "Blocked in accounts" money.

Moreover, one bias that is in open contrast with the perfect information assumption is the confirmation bias.

The intuition of people is really affected by their opinion, in fact "Everything is an opinion" in markets, each one that tries to look for and to distort the information that they find, is affected by this bias.

This is a very typical fact that happens when the journals publish their news, the most left-wing ones will show the information looking under a different perspective compared to the right-wing side ones.

Even numbers during the exit pools are clearly judged in different manners, making understandable the strong importance of a free-Journalism; in fact, the main operators in the news industry tend to allege an opinion toward a certain result, being able to alter the perception in the mind of the voter.

Looking at this alleged example it's quite straightforward to understand that one party is spotted in the bright light and another is critically subclassed:

"Surveys, in less than 4 months Meloni gains 4 percentage points (the same lost by the Lega, which is overtaken by the M5s)" Font: Il Fatto Quotidiano, electoral pools.
This effect can also be misleading in the presence of conflicts of interest, when analysts recommend certain investments, in fact, most of all have their personal money in those ones and so it's interesting for them to push their own firms.

The existence of clear rules of transparency is necessary in order to create an efficient market purified from the conflict of interest.

During the 1975, Fischoff and Beyth have recognized that people tend to think of being able to predict unpredictable phenomena.

This bias has been called Hindsight effect and it can be described as the error people stating, "I already knew it".

The use of this mental shortcut is necessary for investors who want to try to justify their position in order to show a strong sense of control.

The main example can be referred to the wall street analysts before and after the 2008, where in 2007 they were predicting booming economy and after they stated that from facts, everything was clearly predictable.

This one is difficult to be detected before that things happen, because it requires very strong and deep analysis to prove that estimates are wrong; but after it's quite clear to be found since it's easy to observe a disruptive change in mind of the analysts before and after the event.

Another typical mistake which everyone seems to be affected has been discovered by Thaler and Johnson in 1990 and it is called the House-money effect.

People which are doing good investments, are going to be more addicted to assume higher risks and so on, growing the leverage and taking more exposure to their growing capital.

This aspect can be found quite clearly in the 2008 crisis where banks, were gaining stronger and stronger over the subprime bubble, but in the-end they were leveraging their attitude for risk, bringing to the burst of the bubble.

The effects of bearing more risk are dangerous, but they can be quite easily detected from a fair audit over the main players in the market, in this case, banks.

During the 1990 Kahneman discovered the so called "Endowment effect".

It is typical of those people which look only to their beloved "Own garden" and they tend to underestimate the good investments out of the box.

Investors following mostly this bias are brought to think that stuffs that they own are special and so they won't change their portfolios exploiting new possible profitable investments.

This attitude can justify the absence of the market efficiency principles, in fact there can be outside some very good deals which everyone wasn't looking for due to their ignorance.

Under this aspect we can clearly claim very good businesses which no one wanted to enterprise because of their fear for the new, for example Volkswagen and Tesla.

The latter one when Volkswagen was selling cars in more the two hundred countries wasn't still born, but even if the battery vehicles were already in the predictable future, Volkswagen hasn't had the willingness to think out of the box as Tesla did.

The inflexibility of the German firm has brought the necessity of huge money in order to recover the today's technologies, even though being outclassed by the small start-up in several firm indicators.

Another emotionally enclosure deficit is related to the Home bias.

Even if the world market is full of marvelous potential returns, investors affected by this one tend to put their money in the local firms, accepting lower gains.

This aspect represents still a distortion of the market efficiencies principles, in fact I can claim that people were investing in my hometown bank, even if it was brought to fail after years and years of pain.

The "Marche Bank" is the perfectly example of an extremization of this principle, were a nonefficient local actor were moved on toward the savings of common people; this has been a pretty good mistake for the Marchigiani.

Stepping back to our 2008 crisis we can met the Conservatism bias; investors affected by him attribute more values to their forecasts and tend ignore the opinion of the others.

In fact, after the warnings coming from the housing market in 2006 the Federal reserve and specifically Timothy F. Geithner was still saying: "We think the fundamentals of the expansion going forward still look good".

Ignoring some clear and statistically relevant indicators, has been lethal for that period, listening to what the market was shouting could have been avoided what has happened at that time.

The continuous willingness of finance trying to grow away independently from the real economy is strongly in line with this bias, in fact most of the bubbles are created from the overconfidence of investors, stemming from the inability of listening to others and to indicators.

As we can see these are some of the major biases discovered during time, but I need to say that the literature has more and more cases to show and it is still growing fast.

I've tried under this chapter to underline a clear correlation between the crisis, and most specifically that one of 2008 and the behavioral biases, for understanding that shocks seems

strongly aligned with what we have discussed, in fact all the missed signals and all the human cognitive biases has led to the burst of the bubble.

The effects were heavy and most of all the middle-low class has paid the expenses of the games established by the biggest players.

I wanted to concentrate part of my thesis over the deficiencies of the human nature since I've always searched for a reasoning to the unhappiness of poorer families.

The answer seems now clear to my eyes, that we can "Blame" on someone but we need to blame also on our way of acting; we've got, thanks to the research, the answers and so signals, the instruments in order to prevent but not to cure our deficits.

I strongly believe and hope that this part of Finance will gain more and more relevance, since it could give more justice and fairness to our capitalistic world.

The continuous improvement of the system must be to go through the knowledge of our needs and our way of thinking and behaving; no more imposed formalisms should be followed, only the ability of knowing ourselves can let us to reach our personal well-being and so the wellbeing of all the system. (Zahera, Bansal, 2017)

2.3 The Herd behavior and its implications through Game theory

The Herd behavior, as already mentioned in the beginning of the second chapter, is one of the major findings of Behavioral Finance.

It is strongly relevant since it's a factor able to heavily impact the investments and the future market evaluation of securities.

Going into the detail of it, it is a phenomenon that happens when a person tends to lose its personal assessment and follows the indication of others, in particular strongly visible figures.

This behavior relies on following investors which have a strong and tested track record of investment decisions, which may be able to change the mind of the herders quickly.

Some of these ones can be strongly performing fund managers, such as Warren Buffet, but also entrepreneurs, such as Elon musk, or columnists, such as Jim Cramer.

The reasons explaining this phenomenon can be divided in three macro spheres: 1) Imperfect information 2) Status quo 3) The compensation structures.

1)According to the information-based herding, we need to assume that all the investors have both uncertain private information, elaborated through their thinking and a public information, which as uncertain shows the reliability of the font.

For understanding how this herding evolve we need to structure a game, where there are initially two players that can't see the private information of each other, but they can observe the moves that the previous player does. (Signaling)

We can state that the reward of picking a stock (P) could be P=+1 or P=-1, underlining the fact that the return could be positive or negative in the next step of the process.

The game has an order of players and each player get a Good (G) or Bad (B) private information from their fonts.

If the second player observes that the output of the first player is P=+1, so the probability that the first player had good news is "p" where $0,5 \le p \le 1$ and the opposite is 1-p, where $0 \le 1-p \le 0,5$. The second observer can see the action of the first one and according to its own G or B news, it will act or not.

If during the game we attribute Z as the number of good news and Q as the number of bad news, according to the Bayes rule we get that if Z>Q the successive value of P will be Z-Q, meaning that P will have a positive number.

Otherwise in the case where Z<Q we will have every time negative P, getting the "Cascade" of bad news.

In the case of Z=Q the players will be indifferent between investing and not doing so. If we calculate the probability of getting P=+1 through the Bayes' rule after observing the G, we get:

 $\begin{aligned} & \text{Prob}[P=+1|G] = \text{Prob} \ [GiP = +1] \ \text{Prob} \ [P = +1]/\text{Prob} \ [GIP = +1]. \ \text{Prob}[P = +1] + \ \text{Prob}[GIP = -1] \\ & \text{Prob}[P = -1] = \\ & \text{px} \ 0.5/ \ \text{px} 0.5 + (1-\text{p}) \text{x} 0.5 = \text{p} > 0.5 \end{aligned}$

So, this probability states that the first mover, which gets a G signal will rationally decide to invest, and the second actor will be able to observe the action of the previous one, getting a signal of the possible private information which, the first player has got, so G.

If the second actor gets another G will for sure invest, while if it gets a B one according to the previous statement of Z=Q he will be indifferent between doing or not doing.

Why this happens? Because he will have all the reasons to follow its own private information, plus the public information got from its previously moving competitor.

In this case where a third actor sees that the two previous ones has chosen to invest and so two Gs, even if it will have a B private news, it will go straight in the process of investing since Z>Q.

There we call that has started a "Cascade" from the second actor which will create a Herding movement, since Z>Q will every time be verified even if the single investor gets a bad private signal.

This will also happen in the opposite when there are two straight "Not investments" and so two B ones because the third actor will for sure decide not to invest since the signal that it receives is the opposite Z<Q.

The situation where there's Z=Q can also create a cascade from the second movers, because if he sees an investment move from the previous actor, and he receives Bad news so 1=1 this player will randomly choose between investing or not.

If he follows the first mover decision to invest, we will re-see the previously cascade of investment decisions. (Bikhchandani, Sharm, 2001)

Sushil Bikhchandani and Sunil Sharma





Figure 4: Herd behavior in investment decision making; Font: Herd behavior in financial markets Bikhchanda and Sharma 2001

The information-based herding is quite relevant in order to better understand the Technical analysts' hypothesis regarding trends, in fact according to these models, trends are impossible to be reverted since we don't insert in the paradigm different kind of signals.

The securities prices will follow straightly, and the market will see a distortion from the fundamental values or rational values due to the emotivity of the investors.

The Herding explained through the Bayesian model is an impossible to be reverted process from the beginning of the cascade and so the trend following can be clearly justified by this reasoning.

Aston Martin Lagonda Global Holdings plc (AML.L) & LSE - LSE Delayed Price. Currency in GBp (0.01 GBP) 486.10 +8.20 (+1.72%)



Figure 5: Font: Yahoo Finance_ Aston Martin Lagonda index

2)In order to give an answer to the status quo or reputation herding, we can take into account to the literature of Scharfstein and Stein (1990); Trueman(1994); Zweibe(11995); Prendergast and Stole(1996); and Graham (1999).

Each actor in the financial market is concerned about its quality of structuring a good investment and herding, according to this reasoning can be an efficient strategy, let's see why. Assuming that there are two portfolio analysts, getting each one a signal, which could be one good or bad, the two actors will start playing a game, where they start following their information and they start to invest.

As the time goes by, the results of each actors come into the eye of the other (Signaling) and the information processing of the two fund managers will show a certain return of their portfolios.

This game, being a repetitive game, will show that one portfolio manager will show more skills than the other, having a higher information processing quality.

The subsequent consequence will lead to one player to follow the one which will result more profitable, without losing its reputation taking personal decisions, reducing the risk and effort of its work, preserving its status quo.

3)In order to analyze the compensation based herding, we should still take into account an example based on two portfolio managers, where the premium compensation of one is related

to the result of the other and where if the first investor misses its competitor benchmark, its reward will decrease.

This kind of incentive which is strongly applied in most of the firms should lead to a herding behavior of the first agent, since, the benchmark, which is the objective to reach in order to get the premium, will act first and the second investor will observe the move.

Being also this time a repeated game, in order to get the premium reward, the player will incur in an imitative game, eliminating its risk of following its own information. (Bikhchandani and Sharm, 2001).

Having analyzed the main theories of the Herding behavior it can be easily understood its holistically presence in the market.

People tend to aggregate behind others through these peculiar methodologies in order to gain higher returns and bearing the least possible risk.

The market, being made by people itself, is affected by the behavior of them and so as stated from the theory, following the majority of investors is the most irrational but rational strategy to follow.

The market sentiment is heavily influenced by herding and the common thinking will push the prices upward or downward accordingly, creating a sort of "Free-lunch" in it.

The concept of "Free-lunch" is another statement that shouldn't exist in a perfectly competitive market, meaning that it's impossible to have a return without facing an equal amount of risk, but in this case if the rule applies, this statement is overcome.

This concept can be easily seen in the market of tech stocks, such as the Nasdaq.

The medium level of market caps for Startups' Ipos has gone higher and higher over euphoretic expectation from all of them; this has led to the massive injection in the market of unprofitable firms, which during time have lost billions and billions of value after the listing.

The Herding of bringing to the market their Ideas have pushed entrepreneurs to do so, giving billions to firms which have never done a dollar of revenues.

Under this reward for entrepreneurs, there was a market full of liquidity and investors facing an infinite risk, galvanized by the herding through the high market sentiment.

As it is possible to see the market hasn't followed rational or fundamental realistic evaluations, but they were just betting on some structured ideas of some inspiring entrepreneurs.

The so-called firms "Unicorns", having more than 1 billion of capitalization, have boomed over the wave during the after pandemic, for example Farfetch, Beyond Meat, Nikola and Vinco Ventures, but now a days their evaluations have strongly been arrested over the disappearance of the momentum.

Cap 3: Herd behavior in financial markets: An experimental approach

The Herd behavior has been stated as one of the main phenomena discovered and applied by Behavioral finance.

As listed before, through the Bayesian model has been found a simple instrument in order to give a potential answer to the disruptive movements of the market: bubbles, shocks, stagflation and so on.

The financial market has shown on 2021 and also retrospectively booming evaluation of the firms on the main index Nasdaq.

It is composed by the most innovative listed firms which had created the new big tech giants dominating the scene such as Meta, Apple, Alphabet and so on.

The question from the paper that arises is: are those valuations affected by information based herding behavior?

At a first sight over the graph it is quite intuitively that this condition can be found, but through the Bayesian model I'll try to give an answer to this possible fact.



Figure 6: Font: Yahoo Finance- Nasdaq composite index

Under the condition indicated from the model, an investor looking to an upward growing graph will implicitly find an augmented condition of optimism in the market.

Let's understand what this growth means: The index's value is established from the rule of demand and offer, and so the higher the willingness to buy the higher the value this one will reach.

A smart investor observing this trend should look at the past movements in order to predict the future, in fact through the pattern it will get an information from the other operators: in this specific case they are strongly bullish on this asset.

This sentiment can be recalled as a "Public information" which is given to the investor and that strongly suggest buying today a stake in this investment.

Under this precondition, even tough, the investors willing to understand if proceeding in employing money in these assets will make some personal reasonings.

Each one will analyze a series of economically relevant factors, looking at the macroeconomic environment, the fundamentals, actual news and so on, creating an its own thinking over this topic.

This personal interpretation from the investor is called "Private information" and should play a significant role in the investing decision.

According to Bayes, since the pattern is strictly clear, and so the market suggests investing, a wise investor should always invest disregarding to its own personal thinking.

The condition following this process explains the Herd behavior, in fact Bayes states that people follow the trend and they are prone at sacrificing their opinion, even if in contrast, following the main pattern.

According to the Bayesian model of herding behavior we can state that there's the presence of a herding effect since the pattern is strictly upward sloping and this leads to get from the market a continuous positive feedback which cannot be overcome from the thoughts of a single investor.

This situation explains clearly the creation of bubbles, where investors look at the past and replicate their decision up until a point where evaluations, even if seeming totally irrational, continue growing.

The herding creates a situation of euphoria which lead people inside the trend to contradict their thoughts even if in contrast and it drives them to simply follow the consensus.

The successive trend showing the 2001 bubble replicates, in the uptrend, the herding behavior of investors, where a continuous growth has pushed stronger and stronger the purchases, gaining an almost vertical slope of the curve:



Figure 7: Font: Yahoo Finance, 2001 Tech speculation

The effect stemming from this vertical growth can be devastating and can let people refuse the financial market due to the high volatility induced through this behavioral bias.

Lowering the trust in the financial market could cause huge problems and blocks to the healthy development of an economy; in fact, the lack of trust can be reflected toward some main factors:

1)Stability of prices: this is a variable which is extremely important to regulate, since the pure law of demand and offer can be strongly volatile, in fact in situation of uncertainty, see the Coronavirus one, the value of stocks and raw materials have almost reached the zero, which could be a countersense since capitalized firms have reached ½ or 1/3 the value of their own net assets.

Same situation has been verified for the oil prices, in fact during the 20th of April the Crude Brent oil index was available at a -37,63\$ per barrel, which is a non-sense situation, being a good example for showing the potential disruption of the instability.



Figure 8: Font: Yahoo Finance; Crude Brent oil index

2) Availability of resources: it's another aspect necessary for the financing of firms, even if the financial market in European countries is secondary for the financing because of banks, it is the most efficient alternative for selling the stakes of equity to a wide public.

The financing through the market enhance the liquidity of the investments and gives the possibility to finance more risk averse enterprises, which banks usually are not disposed to support.

These last ones, can also be recognized as the most technologically driven, since startups are strongly risky; but now a days the well-being that we see is a result of the financial support given from the market to these innovative operators, such as Amazon, Netflix, Apple, Google, Tesla, but also others nearer to our day to day life, such as Airbnb, Satispay, Shopify and so on. The market represents the main driver for financing the most technologically driven firms, the lack of it could severely damage the innovativeness of the economy.

Even if investors could incur in higher losses due to the higher risk, listing the previously alleged firms should make understandable to everyone the crucial role of it.

3)Willingness to invest: The propensity to invest is the base of actual economy, the lack of certainty causes a too high level of return required according to the risk bearable from investors. In the lack of willingness to invest and so to lend and immobilize money, we will be able to see blocks in the actual living standards, following no newer public and private extraordinary expenditure, but also the ordinary purchases will be affected, since the lack of liquidity in the market will push the cost of money.

The presence of the Behavioral influence over the stability of the market is a must which has to be preserved in order to avoid these potentially disruptive events.

Accordingly, a coherent economic policy should strongly defeats this tendency through studying and applying norms which can moderate the explosion of the Overconfidence.

As stated from Bayes, the Herd behavior which arise, can be calculated through the formula previously alleged in the chapter 2.3, this represents a phenomenon which begins at a certain point where theoretically hasn't an end following a continuously cascade.

In the next chapter of the thesis I wanted to focus my attention over analyzing the possible evolution of this phenomena and in order to prospect an end to it.

Cap 3.1 The end of Herding behavior through the information asymmetry: an experimental approach

According to the model established from Bayes, the cascade of buy and sell from traders is a continuously growing factor which once is started never will end.

Even in the presence of an obviously observable incoherence in this assumption, I've decided to focus my attention and try to operate a game theoretical model in order to answer to the question: "When does Herd behavior ends?".

Looking at the scheme, in order to understand a possible evolution and so, an end to the Bayes herd behavior model, I've started from analyzing the process of the Game.



Sushil Bikhchandani and Sunil Sharma

Figure 3, Font: Bikhchandani and Sharma

We have one first actor Angela, which regarding to its own thinking, alias "Private information", could has a positive (G) or negative (B) feedback toward an investment.

According to her own sentiment she will decide whether to invest or not her own money in that specific asset.

After the decision of Angela, Bob which is another actor, could have himself an own thinking of the asset which could buy, but he is enriched by the fact that he has been able to understand and observe what the previous actor has done.

Accordingly, if he has a positive personal opinion toward the security and Angela has invested, he will for sure buy this asset.

The same will happen in the opposite direction, where, he has a bad thinking and Angela doesn't proceed.

Alternatively, in the situation where Bob has a pessimist private information, but he could observe that Angela has proceeded at buying, he will be indifferent at buying or not if he weights the same his own thinking and Angela's one, so he will randomize his action.

Going through the process we have a third actor, in this case called Claire, she could find herself in a situation where Bob and Angela has invested and so even If she has a private bad information, she should still invest, since the majority of the consensus, Angela and Bob, agrees to buy.

In these cases, we can say that a cascade of buy will start, in fact all the players after Claire should always invest If they equally weight their own personal opinion to the others'.

The rule can be synthesized as following: in the situation where the summation of positive news (Z) is greater than the number of negative news (Q), the investor should always invest.

Z>Q equals the beginning of an investing cascade.

In the opposite Z < Q equals a situation of perpetual not investing, meaning that the pessimism in the market is at the top.

As stated previously this situation seems not to find an end, but as we know from facts, sooner or later the bubble or the plunge ends.

According to this, I've proposed a new way for dealing at this potential incongruence of theory from reality.

Taking into account the fact that people, as stated from the Bayesian model, are able to process just few numbers of variables, they could also incur in an information cascade based on few variables, for instance 2 positive feedbacks and so, if they apply the assumptions of the model, they will just follow the pattern tracked by their predecessors.

In this situation there's an information asymmetry between what the whole market could think and what the single investor does.

Following the model of the Z>Q and Z<Q, I've supposed a situation designed as following:



Figure 9: Herding behavior and information asymmetry disruption

This scheme represents the classical Bayesian game theoretical model, with a cascade following after the decision to invest from Andrea and Irene and after the choice of not proceeding of Silvia and Paolo, in fact the following players Pal, Ciro, Marco and Erica, will anyway do the same action of their predecessors.

Here it's possible to note that the game begins with two different players, inducing two cascade effects which are independent from the others, in fact between the two groups there's an informative asymmetry where they cannot interact.

We could imagine that these two bundles of investors live in different places where a structural barrier impede them to communicate.

The proposition of this scheme shows a potential ending in the situation of John, which is a wise investor that is able to break the barrier between the two groups, in fact, I'm brought to suppose that this wise investor could look over its own "Garden" and should be able to process more variables than its own colleagues.

John in this case is brought into a "Middle world" where he can observe the position taken from all the two cascades and he is able to break the Herding effect.

Why this happens? It happens because being able to observe a positive cascade from Federico's branch and a totally negative one from Giovanni's, he will be indifferent about investing or not, because Z=Q in this case, and so he will follow its own private information, taking an independent decision.

Following this previous reasoning I came up with the following hypothesis:

H1: Information asymmetry overcoming affects the Information based Herd behavior.

This situation applies when for example in an evolutionary game an investor coming from two different countries in the world is able to link two totally contrasting opinions, breaking the information asymmetry between them.

In order to test this hypothesis, I've created the game for understanding if effectively the decision is randomized between investing or not.

I've tested it through imagining a situation where there's a saver which is willing to invest part of its capital.

It has a personal own private information over the certain security which it would buy.

At the beginning of the game its thinking is expressed, being positive or negative.

The game is structured in two questions in order to test firstly the Bayes Herd behavior, in fact he will be put in a cascade where three financial consultants have suggested him to buy.

After the suggestions it will choose whether to invest or not, but accordingly to the model, in the positive cascade he should always proceed, and it will be tested through the survey if this rule applies.

In the second question, I've hypothesized a situation where him, being still uncertain, decides to go away from its own neighborhood, going for a consultancy in other banks with other financial advisors.

Each one of these new ones will suggest him not to do so, being them in a negative cascade which has been created in that part of the town.

At this point the saver, going away from its neighborhood has broken an information asymmetry which was inducing its habitat in a positive cascade.

After having listened to all the opinions applying the rule (Z=Q), now, it should be indifferent between investing or not and so it will be the disruptor of the herding.

Through this game I would try to test firstly if the hypothesis of Bayes could be applied and I will try to give a potential solution to the lack of literature about the end of a Herd behavior.

This reasoning should be verified thanks to the solidity of the assumption of Z=Q and so I expect that the empirical result will be coherent to the model outlined.

Results

The experiment performed through posing those questions to the group analyzed has got back 29 answers for the Bayes testing one and 23 to the experimentally based one.

As it is evident, this one can be classified as a pilot experiment, with a not statistically relevant result due to the restricted number of answers, but the observed facts could outline some interesting results which should be used in order to perform other more statistically deep analysis in the future.

According to the results got in the first question, I can affirm that the cascade effect has been tested again as being a solid theory, in fact the vast majority of the respondents, almost 80%, have changed their mind following the herd, giving an high emphasis on the others opinion even being a small sample.

This aspect outlines that people tend to have a good esteem toward others, showing a good sense of humbleness and toward who has a higher level of expertise, in this case toward financial consultants.





Figure 10: Q1 pilot experiment results

Regarding the last question asked, the result obtained is quite mixed, in fact, after breaking the information asymmetry between the two different geographical areas, the answers to the previously questions have changed, showing surely a disruption of the herding effect. The people still disposed not to invest now represents the 44% while to others now decided to do so have reached the 56%.

These results should somehow confirm what has been supposed, meaning that in a situation where the number of positive feedbacks and negative ones are equal, there should be a break to the herding effect and lead to follow the own personal opinion.





For the following researches this could be a solid starting point, firstly trying to reach a statistically bigger audience, secondly would be interesting to deep dive in the disruption of information asymmetry between the markets.

The analysis toward this argument could be examined through the dichotomy between market makers and market takers, where the barrier between these two actors have, during time, created strong discrepancy in the forecasts of the future paths in the market.

The analysis over the feelings affecting the investment decisions is a huge and hot topic to be followed, the results of the pilot experiment shows the importance of understanding the observable, not straightforward, decision making of agents.

These results have showed once again the effectiveness of the Bayesian theorem, giving them a vast majority of positive feedbacks; even though I have to say that the other 20% of the respondents represent an important minority which has behaved not rationally, contradicting themselves.

The existence, underlined in the test, of errors in people's actions is what I've desired to underline in this thesis, in fact after the researches treated and after the experiment, I've got the confirmation over the relativeness of how actors invest.

Figure 11: Q2 pilot experiment results

The only constraint which is necessary to underline is represented from the relatively low significance of the sample analyzed, and so for the next researches should be interesting to pose the similar game to a bigger majority of respondents.

In conclusion the analysis of Herd behavior and more widely the Behavioral Finance analysis is a holistic subject which has implications in all the aspects of investing.

The Psychology has demonstrated to be at the base of our existence and the merger with Finance has given proved insights of its validity.

This reasoning suggests that the rules explained through the rational theory must show a relaxation of the assumptions, without losing their power, in fact the merger between rational and behavioral could lead to more refined theories able to explain the phenomena that we observe in the financial markets.

The stronger the knowledge about ourselves make us able to implement efficient policies in order to achieve a sustainable development, without occurring in shocks and strong periods of "Euphoria" or of "Sacrifice".

In particular in the future is interesting to find and applying specific instruments in order to detect the presence of Herd behavior.

Conclusions

The aim of this thesis has been pursued looking at the main theories of Behavioral Finance, reaching a huge and complete understanding of the most important behavioral phenomena affecting the financial markets.

The presence of human beings, have characterized a market that most of theories have classified as rational, pursuing the highest payoff possible, without any psychological constraint.

This situation, as previously explained, is effectively biased by numerous factors that characterize us humans as a whole.

Going through the main ones such as Self-attribution bias, Overconfidence one and Herd behavior, I've been able to underline those contradictory aspects which, de facto, influence the market evaluations.

It is possible to see that investments are made through the reason but also emotions, which they can also be called "Errors", but it's necessary to affirm that those ones are present in everyday movements.

The evaluations given in the market, almost every time, differ from what have been estimated from analysts, because the standard rational methodologies following the Capm and multiples, are biased from the lack of information in order to give a fair value to an asset.

Investments are more complicated than supposing that everyone behave in the same way without contradictions, following the payoff maximization rule.

Applied the standard formulas of Capm, there's the necessity to forecast the cashflows to be discounted in the future in accordance with the forecasts of emotions toward that specific asset. The existence of firms objectively "Overvalued" nowadays is something ordinary, but this overestimation sensation is itself due to the application of rational expectation reasoning?

In the future I expect that will be mainly used formulas and methodologies more in line with the behavioral expectation Finance and more accordingly to the evidence coming from the market.

The technical analysis, in its controversiality, have shown an approach which is more able to understand the prediction of the future and it's able to comprehend better the feelings and the expectations of investors.

According to this, is possible to affirm that people behave with emotional constraints, which elicit in them to buy when a resistance is broken and sell when there's a rebound in the graph, delimiting a trend to be followed for the next future.

In accordance to the Herd behavior, I've been able to analyze in deep the reasoning behind this bias, in fact people tend to delegate their decision making, choosing to follow the others as a shortcut of their own thinking.

They do so for few reasonings, searching for getting the highest payoff with the lowest effort and this enable them to fall in a cascade of biases which can bring to the birth of extreme events such as bubbles and shocks.

What has been tested in the pilot experiment has given a result that confirms that agents tend to reply what has been done from the previous ones and so, they are able to modify their opinion and to contradict themselves, even if they are not convinced about it.

The significant result stemming from the experiment has been characterized by the fact that this herding can be overcome through processing the highest number of variables and listening to different and culturally distant opinions, in order to get a holistically deep and rational appraisal over an investment.

The suggestion given from this study has enable me to understand the importance of diversity also in investment decision making, being a driver of growth personally and financially speaking.

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Pilot experiment results

Default report Master Thesis Monticelli Greenwood Filippo_P September 8th 2022, 3:04 am MDT

Q1 - You are on September 3rd, 2022, you have savings in the bank and you want to invest them in a stock. You are presented with an investment opportunity in an energy stock that personally convinces you. Having no other alternatives, you go to the bank and meet your trusted financial advisor, Federico. He strongly advises you against making the investment as he considers it unpromising. Returning home, you meet Andrea, another consultant who also advises you against buying it. When you arrive at the door of your home, you talk about it with your neighbor, who is a bank manager and for a number of reasons, he also advises you not to continue. Finally arrived home and having 3 negative opinions, what do you do? Do you invest in the title?





#	Answer	%	Count
4	Yes, I'll invest	20.69%	6
6	No, I won't invest	79.31%	23
	Total	100%	29

Q2 - Still in doubt, you don't make the investment yet and decide to leave the house again and change neighborhoods. You go for a consultation in 3 other banks with 3 other equally competent financial advisors. All of them, on the other hand, advise you to make the investment as they consider it promising. At this point you are in a situation where 3 people advise you not to proceed and 3 who advise you to do so. What would you do?



#	Answer	%	Count
4	Invest	56.52%	13
6	Not invest	43.48%	10
	Tot	100%	23

Summary

In this paper has been created an overview over the main phenomenon regarding the Behavioral finance and the Managerial decision-making theory in investing.

The scope of it was of underlining the presence of emotions in decision making and in order to analyze their influences.

In the introduction to the paper has been dealt with the dichotomy between rationality and irrationality, in fact, according to the theory, these two concepts have been classified as synonymous of "What is right" and "What is wrong" in determining the actions that people do.

Going through these aspects, has been observed, from the literatures, the presence of agents in the market which behave in two opposite ways, being classified as "Informed traders" and as "Noise traders".

These ones are listed in the opposite sense according to the fact that the Noise ones are characterized by cognitive mistakes and behavioral biases elicited from emotions, while the others, follow an unbiased view, taking advantage of their nemesis.

The existence of these biased traders has strongly affected the assumptions of rationality, where the market tends to adjust itself and people tend to maximize their returns with the minimum possible risk.

In this thesis I've focused on the principal theories and aspects that characterize an irrational player and I've classified and tested the behavioral bias of Herds through a Game theoretical point of view.

In these specific cases I found some peculiar literatures that allowed me to come up with the following possible hypothesis:

H1: Information asymmetry overcoming affects the Information based Herd behavior

In the first chapter has been given an overview over the history of the concept of investing. The definition has been provided and justified looking at the literatures in order the get the meaning of this process expressed as "The activity focused on incrementing capital goods through the acquisition or creation of the economic resources". The background upon which is based the argumentation of the concept of "Investing" has been followed by the analysis of the main evaluation methodologies which now a days characterize the financial world.

Has been listed the foundations of the Capm and Multiples formulas going through the different perspectives which has induced the market to adopt them.

These ones are the representors of the rational theory of evaluation of an investment, being chosen for the high level of simplicity in estimation but being characterized by strong assumptions.

These ones are based over the looking of cashflows and book values of comparable, giving an estimation which is based mainly on economically terms.

So, has arisen the question of creating and incorporating a formula which could be able to understand the difference between the price targets estimated through those methodologies and the real market value shown in the listed firms.

The emotional value concept has been introduced as a potentially valid explanation to this mismatch.

It can be mainly synthesized as the difference between the willingness to accept (WTA) a deal and the rational true value of an asset.

This gap is created due to the emotions and feeling that people tend to allege to an object that they own, being an expression of multiple factors, such as the identity, the sentimental ties and the self-references.

The effectiveness of this methodology finds its fundament in the incorporation of a new factor in evaluations: The emotions.

In the second chapter the analysis has been focused over the economical implication related to the merger between Finance and Psychology, giving the birth to the Behavioral Finance. According to this, has been provided the main concepts of the theory starting from the

overview of the deficits related to the classical rational Finance.

In fact, the assumption under this new approach are relaxed and it takes into account the main phenomena which characterize the mental biases of agents.

The analysis has gone through the introduction of the most representative behavioral biases, analyzing the Self-attribution one, the Overconfidence and the Herd behavior.

The former one has been explained as an emotional status of distortion of the reality, putting the emphasis on personal success instead of personal failures.

The second one, accordingly, characterize investors which had a strong track record and so they tend to underestimate the potential risk associated to a security.

The last one, which will explain the main theories of this thesis, has been defined as the emotional status that brings people to become trend followers, ignoring substantially the personal thinking.

In order to understand the reasoning of the standard Finance and to comprehend why the relaxation of the assumptions has been performed, the main rational theories has been analyzed. Going through the concept of Homo Oeconomicus from Mill, the Markovitz portfolio theory and the efficient market hypothesis of Fama.

The takeover from this summary has begun with the comprehension of the utility theory of consumers, introducing the concept of maximization of well-being of the rational investor; to the foundation through Markovitz of the Capm model of evaluation and to the overview of the efficient market, reflecting in the prices all the available information, without the possibility of excess returns.

In contrast to these previously listed thoughts Kahneman and Tversky have introduced the value function curve.

This new approach incorporates the subjectivity of investors, stating that not all the values aren't equal for each investor and that each one has a personal propensity toward risk. This statement explains the concept of loss aversion, mainly resulting that the pain of losses Is greater than the excitement of gains.

In the second paragraph of this chapter has been performed the critics toward the concept of market efficiency through the phenomenon of Momentum.

According to the Behavioral Finance literatures the markets are biased by the presence of a force which is able to set the pattern of prices in the future, leading them to a trend induced from the past.

This situation creates a distortion with what Fama said: "The markets reflects perfectly the intrinsic value estimated"; while in this situation, the truth has been demonstrated to be the exact opposite.

After the previously listed explanation has been possible to give a consistent explication of the Behavioral Finance as a theory able to justify the phenomena of bubbles and shocks caused mainly by the distortion of the market. In order to go in deep of the understanding of the main biases, an overview of the most recognizable ones has been performed.

The phenomena analyzed enabled to get a deep understanding over the foundations of this branch of Finance, creating the inefficiencies in the market.

Going through them:

1)The disposition effect (Shefrin and Statman, 1985) brings investors to sell good performance securities earlier rather than those ones in loss; explaining why people tend to remain hanged to their open positions burning money, rather than selling and trying to regain their bets.

2)The mental accounting bias (Thaler, 1990), states that people tend to divide the money and weigh them in different ways, money in the bank, money in the pocket, disrupting the rational assumption of the fungibility of money.

3)The confirmation bias affects investors which try to find a justification to all the action that they undertake, and this is able to answer to the distortion in evaluations in the market.

4)The Hindsight effect (Fischoff and Beyth), is based on justifying the actual position in order to express a strong sense of control, de facto, it is characterized by the strong contradiction of don't recognizing a personal mistake.

This overview, in addition to having allowed us to underline again the myriad of mental errors we have to face, has led me to understand how much economic political policies should take these aspects into account.

In fact, the possibility of predicting effects such as Momentum or Overconfidence or Herd behavior would make it possible to systematically reduce market shocks, acting with prevention to the continuous euphoria that distort the economic cycle.

A statement that I considered very important is the following in the face of this summary: The continuous improvement of the system must be to go through the knowledge of our needs and our way of thinking and behaving; no more imposed formalisms should be followed, only the ability of knowing ourselves can let us to reach our personal well-being and so the well-being of all the system. (Zahera, Bansal, 2017).

In the last paragraph of the chapter has been analyzed in deep the Herd behavior as a game changing phenomenon.

The explication of it as gone through the description of the Bayesian theorem, being able to give the fundament of a Herding behavior movement.

This effect is expressed through the game theory, setting a scheme which is based over the concept of public and private information.

The assumption of this game is that an investor being able to observe a higher value of positive or negative information, will fall in a cascade of isomorphism.

This happens because each actor overweight the same the thinking of the others and since the vast majority should be always right, the subsequent actors will just follow the trend.

This process, when is started, reinforces itself and so the number of positive information should lead to infinite while the personal private information will weigh 0.

The rule founding the beginning of the Herd is related to the fact that if the number of positive information (Z) is greater than the number of negative ones (Q) the investor will always follow the majority of the consensus; the same situation applies in the opposite.

Accordingly, to this process of private information Herding, a similar reasoning can be applied to other two ways of Herding, which are the Status quo and the compensation structure ones.

The former one has being theorized and explained through a game following two portfolio analysts, where each one is able to observe the move of the other up until a point where the less skilled one will just follow the most competent, reducing the risk and maximizing the return.

The latter one has been explained through the same agents, two investors, linked with each other by the objective of becoming the best performers, where, the farther the result of the second the lower its wage will be; this situation will lead to the same equilibria.

These explanations of Herding behavior let me find a support of the Bayesian theory inside the technical analysis, explained as "The study of how price movements in a given financial market that helps predicting the future securities trends".

According to this view people behave following trends, support and resistances, explaining the reasoning why evaluations goes through phases which disentangle from rationality.

In the third chapter has been performed a research over trying to understand the existence of an Herding effect in the Nasdaq index during the 2001 crisis and the 2021 post-Covid strong growth.

Has been analyzed the correlation of the phenomenon looking through the Bayesian perspective and the technical analytical one, showing that the presence of a clear downward trend after the breaking of the resistance in 2001 has confirmed the existence of a herding effect.

Similarly, in 2021 the situation has been supposed to be likely equal since the technical supports have been tested and the common thinking of Herds has been observed thanks to the continuous rebounds of the pattern.

The presence of this emotional chart has given a sort of explanation to the common thinking which has been created.

In order to deep dive on the possible effects of this movements, has been performed an analysis over the causes of an emotional trading, going through the negative effect elicited over the major phenomenon of stability of prices, availability of resources and willingness to invest.

This summary has outlined the necessity to intervene in the market through policies able to recognize these trends and to avoid the creation of instability.

In these trends has been observed that, in contrast of what the Bayesian theory has stated, the Herding effect sooner or later ends.

From this deficiency in the last chapter of the thesis I've supposed and created a game in order to overcome the lack of the model.

The analysis has gone through the steps of the Bayesian game and has been inserted a factor able to revert the result of the Z>Q rule.

In fact, the supposition has been performed through creating two different groups of actors, where they do not communicate within each other and that they fall in a Herding effect.

Their impossibility to talk to each other has, de facto, created a barrier which causes an information asymmetry.

Has been supposed that a smart investor will be able to overcome this border and he will be able to observe the creation of two opposite Herding cascades.

The possibility to overcome this situation gives him the power to rebalance the Z and the Q and so, he will be the disruptor of the two chains.

The results of the pilot experiment testify the validity of the Bayesian theory, in fact in the first question regarding the presence of a Herding behavior, about 80% of respondents acted following the Herd.

This aspect outlines that people tend to have a good esteem toward others, showing a good sense of humbleness and toward who has a higher level of expertise, in this case toward financial consultants.

The second question of the survey, on which the experimental study has been based, showed, on the one hand the possibility of breaking the chain of the herd effect, but was biased by a series of factors.

Firstly, the statistical sample was narrow, receiving a number of responses equal to 23.

Secondly, the output was consistent, in fact the fourth player and therefore, the protagonist of the game, changed his idea and followed his private information, for 56% of the answers, while 44% of the time he contradicted the thinking of the majority analyzed.

The result of this experiment is anything but satisfactory since the overcoming of the information asymmetry between the two groups actually gave a result of blocking the Herd effect.

These results should somehow confirm what has been supposed, meaning that in a situation where the number of positive feedbacks and negative ones are equal, there should be a break to the Herding effect and lead to follow the own personal opinion.

In conclusion, the results of the test show how the observation of new and different opinions allows you to think above the patterns and establish your own dominant line of thought over others.