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Theories of investor behaviour: From the Efficient Market Hypothesis to Behavioural Finance

Bachelor's Thesis

Supervisor: Professor Karsten Staehr

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I declare I have written the bachelor's thesis independently.

All works and major viewpoints of the other authors, data from other sources of literature and elsewhere used for writing this paper have been referenced.

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ABSTRACT

The aim of this Paper is to provide an overview of the trends in finance in the 20th century. The study goes through a general analysis of Efficient Market Theory and Behavioural Finance trying to give a unified vision and organized of the matters. The most relevant concepts in support of the Efficiency of Markets will be analysed. The set of concepts and models that constitute Behavioural Finance were elaborated by many researchers and by means of methods and very different approaches. A review of major heuristics is reported, illustrating the importance of psychology in financial markets. Later, we will focus on the major works in antithesis with Efficient Market Hypothesis, about the excessive volatility within financial assets. Finally, an Empirical Analysis about Market Volatility by Shiller is discussed.

Keywords: *Behavioural Finance, Efficient Market Hypothesis, Heuristics, Market Volatility, Empirical Analysis*

INTRODUCTION

The succession of speculative bubbles and financial crises, factors that have increasingly affected the world financial markets in the last twenty years, have revealed most clearly that the assumptions of rationality of investors and the assumption of market efficiency are unrealistic, since they cannot describe the actual behaviour of individuals in front of the risk and not even the way they actually assess available information, formulate their forecasts and implement their investment decisions and portfolio allocation. Numerous studies in the field of Behavioural Finance attempt to overcome the anomalies of the classical theory, the so-called Efficient Market Hypothesis, providing valuable contributions in the analysis and understanding of the functioning of financial markets.

Behavioural Finance is an approach to finance that is far from the hypothesis of efficient markets, for decades' the standard paradigm of analysis, trying to provide answers to the real performance of the financial markets. This new approach includes in its models a psychological perspective, showing how emotional factors can influence the investment decisions of individuals. In fact, the latter do not seem to behave perfectly rational, violating the Expected Utility theory. Behavioural Finance is an approach that marks the meeting of finance with psychology, and more in general, with cognitive science and decision-making. If at first glance it would seem risky and perhaps excessively academic to try to combine disciplines so different from each other for financial market analysis, closer analysis would confirm the need for starting from the study of human behaviour for understanding markets, since individuals are the direct and undisputed protagonists in the market.

The large number of bargaining and negotiations that every day, without interruption, occurring in the world are the result of remarks made by individuals, they are human decisions. The classic models reduce the analysis about the choices and capabilities of the individual to mere standard hypothesis of the study; vice versa, the Behavioural approach leads the individual to a central location and he himself becomes the object of analysis and the explanation of the phenomena of the market that are observed. Because of the complexity of the financial world and the natural biological limits of the human intellect, individuals routinely commit a series of cognitive errors and recur almost always to mental simplifications in the process of collecting and processing information. For this reason, investors often make sub-optimal and irrational decisions, as they do not seem to be able to

maximize their expected utility function; so, they settle for satisfactory choices, given the constraints and the overall context in which they operate. The agents will also be influenced by instincts and emotions, sometimes referred to as Keynesian animal spirit, only to switch between overreaction (overconfidence) and conservative behaviour (under-confidence). These attitudes may over time contribute to strong pressure on the prices of securities and thus encourage phenomena of speculative bubbles and financial crashes.

The problem of the classical finance is the assumption that, with excessive confidence in human capacities, assumes the markets as places populated by perfectly rational individuals with a precise knowledge of the structure of the economy in which they move.

The aim of this study is to provide a general analysis of the Behavioural Finance trying to give a unified vision and organized of the matter. This task is not simple to make, given that it is a very young subject and still strongly heterogeneous, since the set of concepts and models that constitute it were elaborated by a large number of researchers and by means of methods and very different approaches.

The work is structured in three parts, which constitute the three chapters of the thesis: Chapter 1 illustrates the crisis of traditional finance, Chapter 2 describes the theory of Behavioural Finance and Chapter 3 presents an Empirical Analysis by Shiller (1981).

In Chapter 1 are recalled the basic elements of theory of efficient markets: its assumptions, its implications and its derivations. The exposure of these points is followed by that of the criticisms that compared to each of them they have developed in the field of Behavioural Finance, and marking the crisis of the dominant paradigm in the study of finance, namely the neoclassical model. It is presented chronologically the crisis of the traditional model, highlighting the most important discoveries that demonstrated the incompleteness and inadequacy. In particular, the Prospect Theory is described, the theory that paves the way for Behavioural Finance.

Chapter 2 deals with the theory of Behavioural Finance, which studies provide a new perspective and inspiring groped to solve problems that find unsatisfactory solutions in the traditional theory. Initially it provides the definition of the subject, which is a fusion of the human sciences and finance, and presents its short history, indicating the work and its principal authors. Afterwards we analyse in detail the theoretical principles, or heuristics,

which make up the Behavioural Finance: Overconfidence, anchor, representativeness, availability, loss aversion, under reaction and overreaction, conservatism and aversion to ambiguity.

In the last chapter, Chapter 3, starting from the Efficient Market Hypothesis of Fama, will be analysed the most relevant concepts in support of the Efficiency of markets, with reference to empirical evidence derived from these. Later, we will focus on the major works in antithesis, about the excessive volatility within financial assets. The Fama's work gave a wave of enthusiasm to the academic world. For this reason, some years later, the Schiller work aroused a series of disputes, however, in a few years the critics by Shiller was widely accepted by most academics.

Chapter 1

From classical theory to Behavioural Finance

1.1 Traditional Theory of Financial Markets

Before analysing Behavioural Finance, it is useful to provide a general framework, although briefly, of modern finance or traditional finance. In the second half of the twentieth century we have the fundamental contributions that will constitute this new branch of economics that reached the height of its fame in academic spheres around the years '70, thanks to the brilliant contributions of economists such as Harry Markowitz, James Tobin, and Eugene F. Fame. The fundamental corollary of Traditional Finance is the Efficient Market Hypothesis (henceforth EMH), which it states that a market is efficient when at any moment the prices fully reflect all available information and supports that financial markets in the real world enjoy this property. The EMH was formulated at the University of Chicago around 1960, and it was the central financial assumption for about 30 years.

In 1970 appears in the *"Journal of Finance"* the famous article by E. F. Fama, "Efficient Capital Markets: a review of theory and empirical work ", in which it is manifested the first detailed formalization of the efficient market theory. The efficient market hypothesis is the most powerful idea behind the traditional finance, but it is also the main object of criticism from scholars of the behavioural theory. This is an ideal starting point for the understanding of Behavioural Finance.

1.1.1   The Efficient Market Hypothesis

Studies on markets efficiency focus on the mechanisms of formation of prices of financial assets, i.e. on the study of speed and accuracy with which information have positive or negative effects in the prices of financial instruments. The theory of efficient markets assumes that the investor is rational, he has complete information and maximizes his expected utility. In this context, the price is equal to the fundamental value of the share, i.e. the current net value of its discounted future cash flows. When the investor is aware of some information on the fundamental value of the share, responds promptly increasing the offer price when the news is "good", and decreasing it when the news is "bad".

If for example, an investor receives a notice of gains of a company, expecting a subsequent increase in the expected dividends, the price at which he is willing to offer his title will increase, in the position of the seller; in position of purchaser instead, the investor would be willing to pay a higher price to buy the stock. In this way the prices instantly incorporate all the news available, adjusting to the new net present value of expected future cash flows. The EMH states that, in larger markets, which are characterized by sufficiently wide number of operators and transactions, and free markets or with no entry or exit barriers, the market price of an asset: it is the only possible prices; it reflects in a complete and accurate manner all available information, therefore representing the best estimate of the value of the asset; leaves no room for any arbitrage opportunities, given that the prices remain in stable equilibrium in the absence of new information, and they vary in a rapid and correct way every time new information comes.

According to the formalization proposed by Fama (1998), it is possible to identify three types of information, and can therefore be distinguished three different hypothesis of market efficiency: efficiency in weak form, when the price of a stock takes into account all the information obtainable from the observation of the time series. It is not possible formulate a trading strategy with an expected return greater than the market based only on information contained in the time series of prices; efficiency in semi-strong form, when the price of market reflects all the information contained in time series of prices, plus any other public information. Therefore, the use of information on passed prices and amounts, and published information does not allow to obtain an extra profit; efficiency in strong form, when the market price incorporate the information contained in the time series of prices, public information, and all considered private information. Having available the information listed, it is not possible to implement any strategy that will provide an expected return higher than the market.

The strong form efficiency implies the one in the semi-strong form, which in turn implies the one in weak form. The implications are not worth reverse. After these conclusions we can deduce that to the investor would be better to passively hold the market portfolio, and forget the active management of securities. In fact, the average investor (either shares or a pension fund or a mutual fund), could not hope to "beat the market" (get an average expected return greater than the equilibrium) and, all the resources that he employs to analyse, select and exchange titles, would be wasted. In other words, if the EMH is true, the market tells what to do to get better. If we assume the presence of irrational investors, this would not alter the idea

that markets are efficient. It is claimed that trade of irrational investors, being random, has the effect of cancelling each other out (the purchase transaction of an investor will be offset by a sale transaction of its counterpart), with no effect on prices. In the case in which the investment strategies are related to each other, the situation does not change. In fact, for example, when a stock falls below its fundamental value due to the action of an irrational investor, an arbitrageur buys the title in that market and sells it immediately on another market. In this way, the operation of the arbitrageur makes up the price of understated title and restores it to the level of its fundamental value. The action of arbitrageurs keeps the prices close to the core values and therefore allows the storage of the markets efficiency. In the late 70s the assumption of efficient markets appears valid both theoretically and empirically: it seems to be the great triumph of the economy of the twentieth century.

1.1.2 Rationality of investors

According to the Efficient Market Hypothesis, individuals act in a fully rational way, maximizing the expected utility function and following the probabilistic Bayesian rules: thanks to a capacity of infinite computing should not therefore be any complications or in the optimization process or measurement errors within ' increase the quantity and complexity of the information available. The first assumption of the Efficient Market Hypothesis argues that investors are fully rational in their choices, have unlimited capacity and resources collection and processing of information and maximize their expected utility function. In reality, all this does not seem to occur: people often act in a totally irrational and do not associate the chances and risks of events in accordance with Bayesian laws. The human mind is not built to reflect the absolute rationality canons: it is in fact subject to physiological limits and continuously performs selections to store what is most relevant and worthy of attention, instead discarding the superfluous. Information processing is also a full process of valuation errors, due to the limitations of memory and emotions of human beings. The psychologists Kahneman and Tversky (1978) have made various experiments in order to investigate the mental processes that agents use in the evaluation of choices under uncertainty. In their studies they have shown that individuals reason through heuristic rules, ie cognitive filters that simplify and approximate the information, but it can also lead to mistakes and judgmental biases. A heuristic is an intuitive estimation mechanism, which allows investors to make decisions while reducing the complexity of the problem and coming so quickly to make choices, not necessarily absolute rational and optimal, but fully satisfactory, given the constraints of the context in which the

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subject acts; since it is based on simplifications and insights, resulting a possible violation of the classical theory of the formation of expectations and probabilities.

1.1.3 Anomalies in the financial markets

The traditional finance reaches the peak of his fame in the academic and professional authorities in the early 70s. The traditional economic theory was that financial markets were efficient and the empirical evidence confirming almost all the assumptions of the theory. Michael Jensen (1978, pp. 95) states that "there is no other proposition in economics which has more solid empirical evidence of the hypothesis of efficient markets". In short, the academic world is pervaded with great enthusiasm and believes that it has reached the full understanding of the financial world. The first criticism of the EMH will be in the late 70s, when it began to be published the first empirical work questioning the validity of the modern finance rules.

These contributions highlight the existence of events that cannot be explained by the CAPM or are inconsistent with the hypothesis of efficient markets. Many of the disputes about the inefficiency of the markets are linked to a series of abnormalities found with a certain redundancy in the course of the past decades, and whose financial literature provides numerous documentations. In the beginning many of these innovative works are criticized by advocates of traditional finance. But the evidence of existing anomalies is very strong and in fact leads to the birth of a new line of research, Behavioural Finance. From the chronological point of view, the empirical criticism to the efficient markets hypothesis preceded the theoretical ones.

An early study to document an abnormal behaviour of the market yields at certain times of the year were Rozeff and Kinney (1976), which showed a higher average yield in January, compared to the other months. In their experiment were used the shares of New York Stock Exchange (NYSE) in the period from 1904 to 1974, and the result was as follows: the average return in January was equal to 3,48%, considerably higher than the 0,42% relative to the performance average of the other months. This phenomenon, also found in subsequent years and in the stock markets of other countries, is known as the "January effect". By studying the daily changes in prices it is possible to obtain the behaviour of the markets in the non-working days, and extrapolate, then the so-called "weekend effect".

By studying the daily changes in prices it is possible to obtain the behaviour of the markets in the non-working days, and extrapolate, then the so-called "weekend effect". In particular, it is possible to examine whether, when the market is closed, the speed of the processes that generate the price trend changes. Granger and Morgenster (1970) found that the speed of such processes slows down when the market is closed, as a result of a decrease of the variance per unit of time. French (1980) analysing the returns of the shares in the period from 1953 to 1977, showed that the yields tend to be negative on Monday, while on other days of the week tend to be positive.

Recent literature seems to indicate however that the "weekend effect" is no longer detectable in recent years: Kamara (1997) shows that the S & P500 did not show a significant "Monday effect" after April 1982 and Steeley (2001) that "weekend effect" in the UK disappeared in the' 90s. Among the anomalies of "calendar" the more marked is the "month change effect", mentioned by several studies in different markets. Ariel in 1987 has seen a sharp increase in price volatility on the last day of the month. Lakonishok and Smidt (1988) detect for the first time a large increase in the profitability of equities last business day of the month and in the first three days of the following month.

An effect that appears to have very deep roots in time, especially in Europe, is the "Halloween effect". It is a strong seasonal effect that equity returns should be higher in the November-April period than in the period between May and October. Bouman and Jacobsen (2002) find evidence of the effect in 36 of the 37 markets studied and although in the UK this evidence is stronger, it can be said that in the European continent in general the period of the summer holidays seems to bring a strong seasonality in yields. In addition to those examined so far, the so-called anomalies of "calendar", appear in the financial literature also other types of market imperfections, related to different aspects. For example, Harris and Gurel (1986) speak of an "S&P500 effect", after finding that there is a striking price, more than 3%, linked to the proclamation of the inclusion of a stock in the S&P500. This type of anomaly helps to give a shove to the EMH, as the announcement of a quotation within an index, it is indeed an information, but without any content of news, so this evidence is an important except to the assumption of efficiency theory regarding the incorporation of information into the prices.

Finally, David Hirshleifer and Tyler Shumway (2003) studied the relationship for 26 stock market locations, between weather conditions and the sign of trade. The result was that

the sun is strongly correlated with the daily stock returns and which therefore tends to accompany positive business days. The discovery of these abnormalities is clearly a strong attack to traditional financing, proving that the events actually occur absolutely inconsistent with its fundamental laws. For many observers, the empirical evidence of these phenomena has started a real crisis of traditional finance.

Moreover, the situations of speculative bubbles and financial crises of recent decades clearly show that overall stock prices move especially for enthusiasm and exuberance effect of investors. When they believe that a security will be worth much in the future, they are willing to buy it at a rather high price, in the belief of being able to resell it later at an even higher price; if expectations remain unchanged or become consolidated the game is repeated again, provoking strong and continuous increases in prices, without new information reached on the market about the profits made or a future payment of dividends, to justify their real value.

1.2 From expected utility theory to prospect theory

1.2.1 Expected Utility Theory

Every day individuals are in the situation of having to make choices, both under certainty that uncertainty, constrained by available resources. The subjects who behave in a rational way then choose the things which allows him to maximize its own utility, creating an order of preference among the alternatives. Among the psychological theories of human behaviour, the Expected Utility theory is the main theoretical model within the horizon of classical decision. From this perspective, cantered on man as a rational and predictable being in his actions, was proposed in 1947 by Von Neumann Morgenstern, and it has been widely accepted and applied as the economic role model for thirty years, that is until the emergence of a new theory closer to economic reality: The Prospect theory, proposed by Tversky and Kahneman (1971). According to the Expected Utility theory, individuals generally move in reality following the pre-determined behavioural patterns, the base of which there is an assumption that the marginal utility of wealth is always positive. The Expected Utility theory predicts that people who make investment decisions among different alternatives characterized by uncertain outcomes, which are, however, known the likelihood of occurrence, they are able to attach a monetary value to each alternative and, considering that individuals prefer to have

greater wealth than less, always make the most rational choice. It is considered that the market agents have a coherent system of preferences and are perfectly informed.

It specifically describes and studies the underlying individual preferences of consumer behaviour under risk, that is when the individual is called upon to make a decision without knowing for sure what state the world will occur, but knows the list of possible events, each of which associates a probability of realization. In practice it is reasonable to assume that individuals choose among various risky combinations on the basis of their expected utility values: they always choose the combination which is associated the higher expected utility, i.e. the alternatives that offer the highest absolute gains or the lowest losses. The utility function can be, therefore, used to associate to each choice a corresponding utility measure.

Within this theory it has been introduced an important concept, applied in many economic areas, the "risk premium", i.e., the maximum payment that the individual is willing to bestow to eliminate the risk and get with certainty the expected gain of risky combination. In other words, the risk premium measures how the individual is willing to pay to eliminate the risk of choice. This theory has profoundly influenced the academic economic culture as it makes very simple the mathematical modelling of the decision making process. Yet it has found a strong edge in having overlooked some important variables involved in the decision process such as the complexity of the task, the emotional evaluation of alternatives of choice and the cognitive resources limits of the individual.

1.2.2 The Prospect Theory

The Prospect Theory, formulated by two Israeli psychologists Kahneman and Tversky (1979) as opposed to the Expected Utility theory, is a descriptive theory that assigns great importance to the way individuals interpret decision problems. The first major criticism of the Expected Utility theory, the basis of numerous economic models, has been moved by the French economist Maurice Allais (1953), who showed that individuals overestimate the results considered reliable and underestimate the results considered probable. This is in contrast with the Expected Utility theory, according to which the utility of a random event is exactly the linear combination of the probability of each outcome. Inspired by Allais experiments, psychologists Kahneman and Tversky (1979) demonstrated the existence of certain phenomena that contradict the Expected Utility theory: the certainty-effect, the reflection-effect and the insulation effect.

The effect-certainty consists in preference of individuals for a certain event rather than for a likely event. Typically, it occurs that individuals choose a lower value certain gain rather than a probable highest value gain. Unlike that is what is claimed by traditional Expected Utility theory, according to which a person placed in front of two "lottery" with equal utility is indifferent between choosing a lottery or another, they found a kind of choice in individuals different depending on whether the two options with the same expected value had a chance to gain or risk of loss.

The effect-reflection consists in the manifestation exactly mirrored of the preferences regarding positive and negative events. Individuals prefer certain positive events to positive events uncertain and negative events uncertain to negative events certain, that is, the phenomenon is reversed in the passage from the consideration of positive events to the consideration of adverse events. While in a situation in which the results of the possible alternatives are all positive, comes into play risk aversion, in a negative domain (in a situation, that is, in which the results of the possible alternatives are all negative) it is revealed the existence of behaviours of risk preference (risk seeking). Therefore, economic agents behave in a risk averse manner when there is revenue potential, they become prone to risk when the possible results are negative.

The insulation-effect consists in the decomposition of each alternative in its salient elements, in order to simplify the process of choice. Individuals focus on certain parts of an alternative and not consider other. These phenomena represent strong criticism of the Expected Utility theory and the idea that the selection process takes place in a perfectly rational. The main conclusion that Kahneman and Tversky (1979) have reached in the course of their research, appears to be the determination of whether framing effects for which statements logically equivalent (but not transparently) lead to different choices of decision.

The Prospect Theory tries to analyse, therefore, the decision-making process of investors; so, setting the odds and the results of certain lotteries, it aims to examine the behaviour of economic agents in conditions of uncertainty, using no more the expected utility maximization, but by resorting to heuristics or simplifications of reality. The prospect theory is purely descriptive, since it is based on empirical experiments conducted on samples of subjects to which are formulated decision problems. The approach is therefore very different from that

of traditional deductive theories, because the goal is not to provide guidance on how individuals should behave, but only to understand their real attitudes.

Chapter 2

Behavioural Finance

2.1 History

Behavioural Finance took its first steps around the 1970s and 1980s as an application of behavioural economics to financial markets. Its goal was from the beginning that of analyse in a more realistic way financial phenomena to explain the actual behaviour of economic agents under uncertainty. Several empirical studies have shown that, very often, the functioning of markets presents evident "anomalies" in stark contrast to the traditional economic theories based on the assumption of absolute rationality of individuals.

The classical finance is based on the assumption of market efficiency (Efficient Market Hypothesis) and the fact that operators behave more appropriately and optimally maximizing their expected utility function in evaluation and decision-making processes. Behavioural Finance studies, however, show that investors are acting on the basis of emotional and instinctive components, not necessarily so optimizing and rational, the famous animal spirits (Keynes, 1936). Traditional models often fail in their descriptive power, they set it aside to examine the steps leading to the formulation of choices and expectations.

The human mind is in fact subject to biological and physiological limits, that force it thus to simplify the surrounding reality through an approximation of the information obtained or the use of heuristics and cognitive filters. Also, the influence of emotions and feelings leads the subjects to commit evaluation errors, which can then result in irrational and not at all optimal choices, but certainly satisfactory if one takes into account the constraints in which they operate.

The first major work on the subject is undoubtedly the work of Herbert Simon (1955) on the rational choice behavioural model. But the great true precursor of the subject is probably the psychologist Paul Slovic (1969 and 1972). In his fundamental work, he investigates and emphasizes the wrong perception of risk by individuals. The problem posed by Slovic (1969 and 1972) will be the starting point of many subsequent works. According to most of the academic community, Daniel Kahneman and Amos Tversky can be considered the great fathers of Behavioural Finance. With a famous work Kahneman and Tversky (1971) make a fundamental contribution to the field and their ideas still currently enjoy of great esteem by

scholars. The two authors, starting with the presentation of the Allais paradox, where it is showed how the utility of a risky event is non-linear combination of the probabilities associated with each possible result, develop a critical analysis of the Expected Utility theory and the axioms on which it is based (axioms of von Neumann-Morgenstern 1944-1947 and 1953) thus arriving at the Prospect Theory. The two authors have analysed the evaluation and decision making processes of economic agents, with particular attention to cognitive errors and the mechanisms of preferences and choices construction under uncertainty. They have shown through empirical studies that, facing risky alternatives, investors suffer a strong aversion to losses (loss aversion), or regret for a loss much more than they are happy for a profit of the same amount.

Another key step consists of the historical study by Robert Shiller (1981) on the volatility of the equity markets. He has the merit of opening the way to a series of a number of practical studies, which have given Behavioural Finance a highly empirical connotation. These works highlight the existence of events inconsistent with the laws of traditional finance, and these results are defined anomalies. Fischer Black is considered another great protagonist of the behavioural revolution. As president of the American Finance Association, he enthusiastically supports the development of Behavioural Finance. During the annual meeting of 1984 he devotes a special seminar to the topic, presenting formally for the first time the subject to the scientific community. This causes a significant increase of publications, including two famous articles published in the Journal of Finance in 1985, one of De Bondt and Thaler and one of Statman and Shefrin.

De Bondt and Thaler (1985) pointed out that investors in their investment strategies tend to be sometimes too conservative and other times too reactive, while Shefrin and Statman (1985) observed that people tend to sell too soon the rising stocks and hold for too long securities downward. It is interesting to note that many researchers who have studied Behavioural Finance successfully do not have an economic education, but rather come from psychological studies. This highlights the importance of the psychological factor in the financial understanding of the environment. To emphasize even more this component, the Nobel Foundation (2002, web) rewarded Daniel Kahneman, "for having integrated the results of psychological research into economic science, especially concerning human judgment and decision theory in conditions of 'uncertainty". Experimental researches have shown that individuals, in their financial decisions, are not guided by rational economic principles, but

from the context, personal history, how it is proposed the operation and by incomplete information. The explanation that the Nobel Prize proposes to the non-rational investor's behaviour is that the actions of human beings are mainly governed by affective evaluations rather than calculations on expected utility. The example that illustrates this theory is as follows: people would be willing to cross the city to save € 5 on an item that costs 15, but not to save € 5 on an item that costs 125.

In recent years arose various scientific journals devoted exclusively to Behavioural Finance and many universities have started to hold courses and seminars exclusively targeted to the theme. Today, research on Behavioural Finance advances with great pace in many of the largest universities in the world. The subject has achieved remarkable success, but undoubtedly there is still much to understand.

2.2 Theoretical Principles

Is presented below the entirety of theoretical principles that make up the new line of research that we know under the name of Behavioural Finance. The subject is very young and heterogeneous. The set of concepts and models that constitute it was developed by a large number of scholars, so it is natural that lacks a comprehensive and organized vision. For this reason, it was necessary to make a selection, have been analysed theoretical principles more widely shared in academic circles and most cited in scientific papers.

Behavioural Finance has a strong empirical connotation and the recent experimental literature is characterized by a relationship with behavioural principles that come mainly from psychology, sociology and anthropology. It has demonstrated the existence of a series of systematic strategies that people use for information management in decision-making purposes. Sometimes these strategies are used to cope with situations of uncertainty or lack of information, other times they are used to select the relevant information in environments whose information rate is very high.

The psychology of the decision has produced in recent decades a large number of evidence about the difficulty of people to manage uncertain or poorly structured decision-making situations. Psychologically, when the number and frequency of information grows, the brain attempts "shortcuts" that can reduce the data processing time in order to take a decision, however. These "shortcuts" are defined more formally heuristics, decision-making methods

based on rapid and simple rules rather than on a logical and rational mechanism. The heuristic is the process by which individuals find the information they need in-house rather than outside.

Kahneman and Tversky (1971) are the first to illustrate the "heuristics biases", distortions related to the use of heuristic strategies. From the work done by these two authors emerge three main heuristic behaviours that may generate errors in decision-making: representativeness, availability and anchoring, which will deepen below. The heuristics allow to manage in a rapid and selective way the information available by resorting largely to intuition. But if on one hand they simplify the work of our mind, on the other they can lead to incorrect or oversimplified conclusions, given the limited time and the incompleteness of the decision-making process.

These distortions (biases) cognitive and / or emotional determine (Kahneman and Tversky, 1974):

1) errors in individual investment decisions, leading to insufficient returns or excessive risk exposure;
2) collective biases. If these individual behaviours add up and exceed a certain critical level it creates a rapid "contagion" effect, and phenomena related to the individual investor become collective;
3) generic market inefficiencies, such as wrong prices or anomalies in returns between different activities, investment periods, etc. The Behavioural Finance seeks to identify and understand these distortions and anomalies and, where possible, to exploit them in the determination of optimal strategies investment.

In the following, the main heuristic behaviours found over the years by various authors are illustrated.

2.2.1 Overconfidence

Among the various heuristic behaviours adopted by individuals, overconfidence is one of those most studied. This term is generally understood as the attitudes of overestimation of their own abilities. Many individuals have an excessive confidence in their own ability, that overestimate their skills, their knowledge and accuracy of their information. The concept of overconfidence is one of the most studied phenomena by Behavioural Finance. The fundamental work was published by Lichenstein, Fischoff and Phillips (1977), later a vast

literature has developed, through the work of many economists. In addition, the overconfidence was confirmed by a long series of experiments in cognitive psychology applied to various professional fields such as engineering field, entrepreneurial, psychological, legal, and managerial.

The overconfidence greatly influences the behaviour of investors in the financial markets. It is useful to underline how the excess of sureness is a characteristic of people, and not of the market. To be considered particularly skilled and competent leads the agents to carry out operations that do not normally would be. In particular, the rate at which an investor buys-sells its bonds appears significantly affected, plus an operator is overconfident, the more he will carry out purchases and sales on the market. Barber and Odean (1999) show that the presence of overconfidence in financial markets lead investors to make unprofitable trading.

In particular, they explain how these last, on average, selling after various time intervals, are unable to cover their costs, obtaining a gain lower than the 6% (which is the average percentage of the transaction costs). The youth workers who have experienced relatively bright performance increase confidence in their abilities until they become over-confident. Overconfidence takes on an upward trend and then decreasing during the life of an agent. On average, the confidence level is higher for those who are present since less time in the market. The Most experienced they are instead people develop an evaluation process of their own capacity more objective. Olsen (2000) asserts that the overconfidence in their own ability is a reasoning strategy that has been developed for evolutionary reasons, and to adapt to everyday life.

First there would be an asymmetry between positive and negative emotions so the confidence in their abilities, associated with suppression of negative emotions, would allow also facing very harsh environmental conditions while maintaining a good level of motivation. Furthermore, according to the author people judge the accumulation of different alternative information among them as a series of different tests all favorable to a certain data, and not as a series of interchangeable evidence. De Bondt and Thaler (1995, pp. 389) stated that "perhaps the most robust discovery in cognitive psychology is that people are overconfident". This indicates how important is its presence to understand how individuals move away from perfect rationality foreseen in the traditional theory.

2.2.2 Anchoring

The anchoring heuristic is the tendency to cling to the original figures and hardly change their initial ideas on the basis of new data. It was observed that individuals form their own estimates based on an initial and arbitrary value and then adjust it according to the new information, but often the process of adjustment is insufficient, since individuals dwell too much on the initial value (Barberis and Thaler, 2003).

Anchoring is a very important principle in the financial markets. Not having better information, many operators rely on the stock price at a given time or a short period, without considering the history of the title and the variability of its price in the past. A title may have a very high value today but not be a safe investment because in the past has held a very fluctuating trend with strong growth in value followed by equally sharp declines.

2.2.3 Representativeness

The representativeness shows how economic agents tend to make their choice on the basis of stereotypes. In other words, the representativeness indicates that the way in which it is established the probability of an event depends on how that event is "representative" of a certain class of events, not considering the real characteristics or probability. The representative term in this case is synonymous with similarly. This principle was introduced by Kahneman and Tversky (1972), developed by Kahneman, Slovic and Tversky (1982) and later cited and reworked by many authors. Werner De Bondt (1995) described it as one of the three essential principles of Behavioural Finance.

2.2.4 Availability

The availability heuristic is another important principle that influences the decision-making process of individuals. Its first explanation is contained in a famous work of Kahneman and Tversky (1974), which define it as the phenomenon in which decision-making is influenced by the ease with which examples and associations come to mind to the individual. The availability heuristic leads to decision-making estimates on the basis of the retrieval of samples from the memory. It has been ascertained that the information most used are those of faster access or easy to understand. In providing an estimation regarding the possible happening of future events people use their experience relative on the occurrence of those events in the past. However, the information that are retrieved from memory are not the ones with the greatest

informative power but are often the most intense, they are i.e. the information to which the individual has associated the strongest emotional connotations. Events that occurred more frequently in the life of an individual or that have impressed most will be judged as more likely though in reality they are not.

2.2.5 Loss Aversion

The loss aversion has been considered and analysed for the first time by Tversky and Kahneman (1979) as part of the formalization of the Prospect Theory. As we saw in section 1.2, the loss aversion is the asymmetry of individual behaviour in the treatment of losses compared to gains. In particular, under conditions of uncertainty, panic and fear of losing € 1 it is much more intense and higher (in absolute value) than the joy of gain one. In other words, individuals are more sensitive, in terms of marginal utility, to a decrease of their wealth invested rather than to an increase of this. In assessing the expected utility then, the investor weighs most heavily losses than wins.

2.2.6 Under-reaction and Overreaction

Much of recent research has dealt with two important phenomena that occur in financial markets on a regular basis: under-reaction and overreaction. The under-reaction can be defined as the phenomenon in which the prices of securities "under-react" to the new information in the short term, or move slowly and poorly in reaction to the announcement of the news concerning them. Generally, it occurs that the average bond yield in the period following the publication of good news is higher than the average performance in the period following the publication of bad news. This may mean that the title under-react to the good news at the time of its publication, but corrects this error by offering higher returns in a period immediately following which is generally one year (Barberis, Shleifer and Vishny, 1998).

There is ample empirical evidence demonstrating the under-reaction phenomenon. Among the most important contributions, Cutler, Poterba and Summers (1989) have examined and confirmed the existence of positive autocorrelation of stock returns in the short term, which implies the beginning under-reaction and then an adjustment of prices to new information. The overreaction can be defined as the phenomenon in which the prices of securities "over-react" to the new information in the long-term, or excessively move in reaction to a series of news concerning them. Generally, it occurs that the average bond yield in the period after the

publication of a series of good news is lower than the average yield in the period following the publication of a series of bad news. This may mean that the title over-react to the series of good news when they are published, but corrects this error by offering lower returns later (Barberis, Shleifer and Vishny, 1998). There is ample empirical evidence also demonstrating the phenomenon of overreaction. Among the most notable contributions, De Bondt and Thaler (1985) and Fama (1998) showed the existence of negative autocorrelation of returns during 3-5 years following the series of ads, which implies at the beginning overreaction and later a price adjustment to new information.

2.2.7 Conservatism

Another common prejudice that affects the decision-making of individuals is conservatism, defined for the first time by Edwards (1968). It is defined as a resistance to change, a tendency for individuals to maintain their beliefs or change them slowly, even before the evidence to the contrary. This principle finds numerous applications in the financial field and many scholars believe that it is at the base of the under-reaction phenomenon. Conservatism explains regularities in the financial markets, which would otherwise be difficult to interpret.

2.2.8 Aversion to ambiguity

The first conceptualization of this heuristic behaviour is contained in a famous work of Daniel Ellsberg (1961), passed into history as the Ellsberg paradox, which shows that people prefer to bet on a lottery with probability notes rather than a lottery with ambiguous outcome. In the experiment are prepared two urns, one containing 50 red and 50 black balls, the other containing 100 balls with a combination of red and black balls unknown.

To players is proposed a first choice: A) to extract a ball from the first urn, receiving $ 100 if it's red, and $ 0 if it is black. B) pull a ball from the second urn, receiving $ 100 if it is red and $ 0 if it is black. Ellsberg noted that people prefer to extract from the first urn (event with known probabilities) rather than from the second (ambiguous event). This experiment shows that people prefer to deal with known distributions rather than unfamiliar.

So aversion to ambiguity is the typical attitude of individuals to refuse ambiguous situations.. Fox and Tversky (1995) explain that the main cause behind the aversion to ambiguity is the comparative ignorance. According to the theory of comparative ignorance,

aversion to ambiguity arises when the individual notices the contrast between his limited competence of an event and its superior expertise in another event.

2.3 Application of theoretical principles to financial markets

In this section we study the application of theoretical principles previously analysed to the contested reality of the financial markets. The finance scholars have observed the behaviour of the various markets, identifying a number of situations to which neoclassical theory fails to give a satisfactory explanation. The goal of behavioural finance was therefore to try to explain financial phenomena sometimes unclear. Have been selected for this analysis the most famous and the most recognized empirically, within various financial realities. It will be analysed one of the most frequent phenomena concerning the behaviour of the aggregate stock market: the equity premium puzzle. Another area of analysis is the behaviour of individual investors, i.e. all individuals working in the market individually without adequate technical preparation. In particular, it will be considered the disposition effect phenomenon. Third area of interest is the behaviour of institutional investors, or large financial organizations that collect and manage enormous amounts of capital, in particular will be exposed to the phenomenon known as closed-end puzzle.

2.3.1 Equity premium puzzle

The equity premium puzzle, the "paradox" of the bonus associated with equities, is a term coined by economists Rajnish Mehra and Edward C. Prescott (1985), who observed it for the first time in their work "Equity Premium: A Puzzle" of 1985 studying the trend of the US financial markets in the period between 1889 and 1978. The equity premium is defined as the difference between the return of the stock market and return on government securities, and the equity premium puzzle can be defined as the phenomenon whereby equities historically offer a much higher annual return compared to risk-free securities.

It is not easy to explain theories and financial and economic logic, the reason why the investors, even if they have a long-term time horizon, do not take the opportunity to buy stocks that offer high yields, and direct their preferences towards government securities and bonds that have lower returns for equity assets. This leads to the consideration that investors have a perception of the risk is too high compared to historical performance actually achieved by equities. We talk about bonus associated with their stocks because the greatest gain ensured by

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equity investments seems to be an acknowledgment to the investor who decided to deal with the high variability of the stock return. The interest in this phenomenon stems from the fact that, considering the assumptions of economic theory, investors should be extraordinarily risk-averse to ask such a premium in respect of an investment in shares. The conclusion is that actions seem much more advantageous than any other form of investment but, being considered riskier by investors, are also destined to a minority role in investment portfolios. The central element of the equity premium puzzle is therefore the level of risk aversion among investors that is implausibly high. Behavioural finance suggests two different approaches to explain this phenomenon: the first is based on Prospect Theory, and the second is based on the principle of aversion to ambiguity.

The first approach was proposed by Benartzi and Thaler (1995). They argued that the high historical value of the premium for the risk, and therefore the investor's reluctance to bear the risks of an investment in shares, it can be justified by introducing the concept of myopic loss aversion. They imagine a model in which an investor should allocate assets between equities and government bonds, in which it is assumed that the gains and losses correspond to positive and negative changes in personal wealth. The myopic loss aversion is the result of the combination of two psychological aspects that characterize the behaviour of investors: Loss aversion, or the tendency of individuals to be more sensitive to losses than to gains; Mental Accounting, the tendency of individuals to decode the information based on various mechanisms, including the temporal frequency of receiving news.

The second approach, aimed at providing an explanation for the equity premium puzzle phenomenon is based on the principle aversion for ambiguity, the tendency of individuals to refuse bets in which they do not know the probability distribution. This situation is rather usual in financial reality, as investors are often uncertain about the distribution of the return on an equity security. The application of the principle of ambiguity aversion to equity premium puzzle problem was conceived by Maenhout (2004), which is based on the work of Anderson et al. (1998). When the investor is worried by the uncertainty of its calculation of the yield of a security, he requires a much higher equity premium as a reward for the ambiguity of the probability distribution.

However, Maenhout (2004) noted that the justification of a high equity premium as the real one requires a level of very considerable concern. So, aversion to ambiguity can be

considered only partially a solution phenomenon examined. Finally, it should report that in recent years there has been a marked reduction in the risk premium. One explanation was that the consistent presence in current markets by institutional investors and pension funds. Framing a view of the phenomenon of Benartzi theory and Thaler (2005), one could say that the equity premium has fallen because economic agents are now characterized by a lower loss aversion, and also because their time horizon is stretched, or there is greater confidence in stock investments.

2.3.2 Disposition Effect

This phenomenon has been described for the first time by Shefrin and Statman (1985) as the tendency of investors to sell winners too early, or stocks with positive performance, and to keep for too long the losers, non-performing credits. The model by Shefrin and Statman explains the disposition effect using three behavioural principles: prospect theory, the theory of regret and self-control. The Prospect Theory of Hahnemann and Tvesky provides a first explanation of the phenomenon. According to this scenario, the investor in his decision-making process initially is subject to the editing stage, in which he interprets the various alternatives in terms of gains and losses in relation to its reference point, and then is subjected to the phase of evaluation, in which he adopts a concave value function for gains and convex for losses. So the investor is characterized by risk aversion in earnings and risk appetite in losses.

Another valid explanation to the disposition effect offers the theory of regret. Regret is the trend, which many individuals manifest, to have a strong sense of dissatisfaction, caused by regret for not having done the best action. The positive counterpart of regret is pride, which occurs when there is an awareness that the decision led to the best results. An investor who bought a title a month ago has two possibilities: if the title has depreciated he regrets, if the title has appreciated he feels pride.

The last explanation to the disposition effect is derived from the principle of self-control. Glick (1957) is the first to propose the interpretation of the reluctance to realize losses as a self-control problem. According to the definition of Thaler and Shefrin (1981), self-control consists in the conflict between the individual's fundamental components: the rational part, the planner, and the irrational part, the doer. Assume that the investor keeps loser for a long time to delay regret and sells winners too early to try pride. According to this perspective, the doer incorporates human emotions so determines the reactions associated with regret or pride. If the

planner is strong enough to limit interference of the doer in the decision-making process, the individual manifests self-control then sells the losers limiting losses and holds the winners by increasing earnings. If the planner is not strong enough, the individual does not control itself and give in to impulses of the doer. Then the individual adopts the behaviour that we know under the name of disposition effect.

2.3.3 Closed-end fund puzzle

As part of the behaviour of institutional investors, one of the most important issues is the phenomenon we know as closed-end fund puzzle. The mutual funds are financial intermediaries that collect the money of savers, which devolved the management of their savings to a management corporation with capital and legal personality distinct from those of the fund. Mutual funds invest money contributed by the underwriters in securities that make up the fund's assets undivided, to which each investor holds a number of shares. The subscriber is not the owner of a specific title in which assets are invested, but owns a percentage of total stock holdings. In other words, buy a share of a fund is to invest in a small portfolio of securities of the same composition of the fund. The law guarantees to all investors equal rights in respect of each participant, in terms of diversification and performance, regardless of the amount invested. The difference will be in the profit sharing that will happen, of course, in proportion to the number of units held.

The closed-end funds are a particular type of funds whose main feature is the fixed capital structure, the number of units issued is therefore constant. Closed-end funds are investment vehicles that collect the money of investors at the beginning and then invest them until maturity, not allowing subscribers to obtain a refund of the fee before the deadline. The only way out for this type of fund is the stock market, where they are treated. Investors who want to liquidate their position thus cannot return their shares to the trust but must sell them to other investors.

The value of investments is called NAV (Net Asset Value), and it is the market value of all the securities held in the fund portfolio and is calculated for each share. In many cases, the fund's shares are listed on the stock exchange and can be traded at a premium, i.e. a higher price of the fund's market value, or at a discount, i.e. at a lower price of the fund's market value. The closed-end fund puzzle is the phenomenon by which the shares of closed-end funds are traded at a price different from the NAV. Since the closed-end fund are listed, the price of a single

share is determined by supply and market demand and is usually different from the value of the corresponding underlying assets.

According to the analysis by Lee, Shleifer and Thaler (1991), the closed-end fund puzzle consists of four main parts, which together characterize the "life cycle" of a closed-end fund:

1) The closed-end fund is issued at an average premium of 10%, due to various start-up costs and that such a high price is accepted by investors;

2) The closed-end fund drops to an average 10% discount within 120 days from the listing;

3) a discount of closed-end fund is subject to very large fluctuations over time;

4) when the closed-end fund is liquidated or transformed into an open-end fund, the price increases, converging to the NAV, and the discount decreases greatly.

Lee, Shleifer and Thaler provide a behavioural matrix explanation to the closed-end fund puzzle, based on the model of Waldmann et al. (1990). They suggest the existence of two types of investors: the rational and irrational investors (noise traders). The first they form their expectations rationally based on the available information, while the seconds are influenced by sentiment and therefore overestimate or underestimate the expected returns according to the period. In fact, the noise traders mistakenly think they have more "special" about the future trend of prices of risky assets. The equilibrium price in each period reflects the views of both the rational investors and irrational investors. In response to the actions of noise traders, rational investors buy when noise traders lower prices and sell when the noise traders make them up. The model makes two main assumptions. First, it is assumed that rational investors have short-term horizons, as in reality because many professionals are subject to frequent performance appraisals. In addition, it is assumed that the feeling of irrational investors is stochastic and cannot be perfectly predicted by rational investors. They conclude by saying that the price of securities depends on the feeling of irrational investors, that is, from their optimism or their pessimism.

This variability in the sentiments of noise traders creates a new source of risk in the market in which they operate. The authors claim that irrational investors prefer to hold the securities of closed-end fund rather than the titles that constitute the closed-end fund portfolio. If the same individuals invest in the fund's shares and securities held in the fund portfolio, their feeling would affect both the NAV and the market price. From this, it follows that all the owners

of the fund are subject to two sources of risk: the risk associated with the fluctuations of the securities that make up the fund portfolio and the risk associated with the fluctuations of the feeling of irrational investors. The latter, the noise trader risk is systematic and therefore influence the performance of various other titles. According to this perspective, the noise traders are the major shareholders of the closed-end funds and their feeling is the determining factor of the closed-end fund puzzle. The theory of Lee, Shleifer and Thaler is the most popular explanation of the closed-end fund puzzle from the proposed and certainly represents a major achievement of Behavioural Finance. The closed-end fund is generally sold at a discount because of the unpredictability of the behaviour of noise traders, which involves an additional source of risk. The discount is high when investors are pessimistic, and the discount is low when investors are optimistic. Investor sentiment determines the discount of closed-end funds and influence the performance of stocks traded by the same audience. So, the level of the discount of closed-end funds can be considered an important measure of market sentiment.

2.3.4 The psychology of the masses and the effect of Herding Behaviour

The influence of the group's views on the individual's behaviour is very strong, especially in decision-making situations of uncertainty; this attitude is compared to that of animals that move in drove and is called herding behaviour. On the financial markets it has been observed that investors tend to conform and imitate the actions and opinions of others, without so develop their own personal assessment. This aspect is not sufficiently considered by the classical theory, which supports the independence of the decisions of economic agents, postulating that, for example, any evaluation errors follow a random walk.

Empirical evidence, however, shows that there is a market aggregate behaviour and relationships derive from belonging to a social network create a dense network of communications and a continuous exchange of information that will attract attention, influence and condition ideas and actions, so much that it gets to real group decisions. The phenomenon of imitative behaviour is a consequence of social relations: it arises from the individual's dependence on the environment in which he lives and it is often amplified in critical situations and uncertainty, in which it is much more delicate to take counter current attitudes. People were afraid to take their own decisions that may turn out to be wrong later, especially when the error is more likely to occur. In the realization of a negative performance it exists therefore a kind of

joint responsibility of the group, which reduces the sense of regret of the individual for the wrong choices and can lead to superficial and sub-optimal ex ante assessments.

The impact of social variables and consequently the influence of emotional, psychological and relational behaviours can be an element of inefficiency in the financial sector. A clear example of this phenomenon and, above all, excessive attention paid by investors to the market is the number of investment clubs, which are small private groups of people who come together to plan together the best lines of investment in terms of risk-performance; they are usually collective investment funds, investing small amounts of money for fun or in order to acquire greater investment expertise (Shiller, 2000). There has been an impressive combination between the number of investment clubs and market performance.

The first major study on herding behaviour was that of Smith, Suchanek and Williams (1988), who conducted six simulations of the stock market, in which each subject was in possession of complete information. Nevertheless, simulated markets have proven very unstable and characterized by continuous phenomena of speculative bubbles and financial crashes, in line with the actual empirical evidence. The cyclical nature of the increases and the reductions reflect a habit of investors to follow market trends and trends of the moment, without any concern for the maximization of their expected utility. Indeed, individuals contrary to rational paradigms of the classical theory, implement conservation strategies (under-reaction), then followed by sudden reaction (over-reaction). The authors also noted that this type of behaviour is not confined to inexperienced financial investment entities, belonging to the research sample, but it is also widespread among industry professionals.

An important study by Prechter (2001) has shown that compliance with the group's behaviour is counterproductive for those who invest in the financial markets. According to the author the majority of individuals acquires much of the knowledge from other people, from the newspapers, by television or by analysts, without trying to verify its accuracy. They think there is no reason to check the information, since they are obtained from experts or alleged; this causes a strong number of subjects showing unconsciously influenced by external events. The market would then be equipped with an autonomous behaviour that emerges from the tendency of individuals to conform to the signals coming from the environment, such as analysts' forecasts or opinions of other investors.

This creates, in the financial markets, a kind of "group thought", which can be understood and explained by the thoughts contagion theories (Lynch, 1998 and 2000; Shiller, 2000). The media therefore have such a power in attracting and directing attention to certain news that end up persuading people, thus promoting the emergence of strong beliefs and collective opinions. The task of the media should be to transmit pure news; in fact, they often distort information, emphasizing, dramatizing and even manipulating it. Some empirical studies have been carried out to investigate the role of the mass media distortions that may result in the financial sector.

A study by Mullainathan and Shleifer (2002) identifies two types of such inefficiencies: an ideology bias and a spin bias. The first stems from a desire of the publisher to influence the opinion readers; the second depends instead by the inclination to exaggerate the facts, with the aim of telling amazing stories that make headlines. These errors are dangerous to the stock markets, as they can impact on the delicate balances that govern them, drastically changing the forecasts and expectations of the agents and, accordingly, the allocation of their investments. The herding behaviour, fuelled by the irrational behaviour of individuals and strongly emotional, can stimulate active investment strategies based on momentum (positive feedback strategies) and even lead to phenomena of speculative bubbles and sudden price falls, not justified by the traditional theory of 'efficient markets. An extreme case of excessive collective reaction is represented by speculative bubbles, during which the financial asset prices, favoured by the emotional drive of investors and the more optimistic expectations of future increases, begin to rise at a sustained rate, up to swell dangerously, without that there is new information on the market that justifies such an increase.

Chapter 3

Informational inefficiencies in markets

The theory of efficient markets of Fama (1970) has been the focus of economic theory throughout the 1970s, especially -"because of its ability to use rational expectations to tie the finance and the wider economy in one elegant theory"- (Shiller 2003, p. 83). However, already at the time there were some publications the anomalies of this model: the same Fama (1970), as has been said, he noticed some serial dependencies in market yields, without illustrating in detail the size. Since the 1980s, have been carried out a series of econometric analyses on the validity of the efficient market model based on time series of prices, dividends and profits. They were discovered several anomalies, and among them the problem represented by the excess of volatility proved much bigger than they could imagine. The following sections analyse the main theories on excess volatility in the markets, and will consider the current development of the common thoughts of inefficiency of markets in a behavioural perspective.

3.1 Market volatility

Among all the theories in conflict with the efficient markets hypothesis, those related to the excess of price volatility are arguably the most relevant. The issue was addressed for the first time in the early 1980s when Shiller (1981) has obtained the existence of some "limitations" imposed on the volatility of prices and returns by the efficient market theory. From these, the econometric analysis of the markets showed that they are not respected.

3.1.1 Robert Shiller and the "ex post Rational Stock Price"

Shiller (1981), comes close to "excess volatility puzzle" taking the concept of "ex post rational stock price", which is the present value discounted of the sum of the real dividends subsequent to the current period, using a "graphic" approach to the empirical analysis. The equality imposed by the theory of efficient markets between the current price and the ex-post, brings out a bond for which the volatility of the current price may not exceed the present value of the estimated real dividends.

Shiller (1981), considering the model of efficient markets, defines the P_t real price of a share at the beginning of the current period t as follows:

$$P_t = \sum_{k=0}^{\infty} \gamma^{k+1} E_t D_{t+k} \tag{1}$$

The term $E_t D_t$ is the expected value of the dividend paid at the end of period t, conditioned by the information available at time t, and $0 < \gamma < 1$ is the real discount factor assumed constant. The information in t includes P_t, and D_t, and their previous values, as well as other variables. It assumed the return given by the purchase of the share at time t and its sale at time $t+1$ as $H_t = (\Delta P_{t+1} + D_t)/P_t$. The first term of the numerator is the capital gain obtained from the change in the selling price in $t + 1$, while the second term is the dividend paid at the end of period t. If it is assumed constant over time the return r, is valid the condition $E_t(H)_t = r$. Using r as the discount rate in (1), the discount factor is equal to $\gamma = 1 / (1 + r)$. This model can be rewritten considering a growth factor in the long run. Are defined $p_t = P_t/\lambda^{t-T}$ and $d_t = D_t/\lambda^{t+1-T}$ where the growth factor is given by $\lambda^{t-T} = (1 + g)^{t-T}$; g is the growth rate, while T is the base year. Dividing by the growth factor in the previous model can be obtained as follows:

$$p_t = \sum_{k=0}^{\infty} (\lambda\gamma)^{k+1} E_t D_{t+k} = \sum_{k=0}^{\infty} \bar{\gamma}^{k+1} E_t D_{t+k} \tag{2}$$

In order, for the equation to give a finished price is necessary that $g < r$, then it is assumed $\bar{\gamma} = \lambda\gamma < 1$ and $\bar{r} > 0$, the discount rate for p_t, d_t obtained from $\bar{\gamma} = 1 / (1 + \bar{r})$. This discount rate is simply the ratio between the average dividend and the average price. In fact, placing the expectation operator for both terms of the model we get the following:

$$E(p) = \frac{\bar{\gamma}}{1 - \bar{\gamma}} E(d)$$

Using $\bar{\gamma} = 1/1 + r$ and solving in the equation it is obtained that $\bar{r} = E (d) / E (p)$. It is possible to express the model in terms of the fundamental value of the asset p_t^*, expressed as the present value of future dividends discounted at time t. "Furthermore, p_t is the mathematical expectation conditional on all information available at time t of p_t^*, and in other words p_t is the optimal forecast of p_t" (Shiller, 1981, pp. 422).

$$p_t = E_t(p_t^*)$$

$$p_t^* = \sum_{k=0}^{\infty} \bar{\gamma}^{k+1} d_{t+k} \tag{3}$$

For analytical purposes, setting an arbitrary value as "terminal value" of p_t^*, it is possible to recursively determine a good approximation of the result of p_t^* series, coming back from the last date: $p_t^* = \bar{\gamma}(p_{t+1}^* + d_t)$

Proceeding backwards from the last date, the importance of the chosen "terminal value" decreases. As we proceed backwards from the last date, the importance of the chosen "terminal value" decreases. In Shiller data (1981, p. 425), for a period of 108 years from 1871 to 1979, $\bar{\gamma}$ is .954 and $\bar{\gamma}^{108}$ (108 is the terminal value) is equal to .0063, close to zero. Therefore, at the beginning of the time series of the sample, the "terminal value" chosen has a negligible weight in the determination of p_t^*. By choosing "Terminal values" different, the result would be to add or subtract an exponential trend from graph p^*. You can observe this effect in Chart 1, which shows the uncertainty in p^*, in which it is calculated from "Terminal values" alternative (the central   curve   is   that   used   for p^* in   the   graphic   analysis).
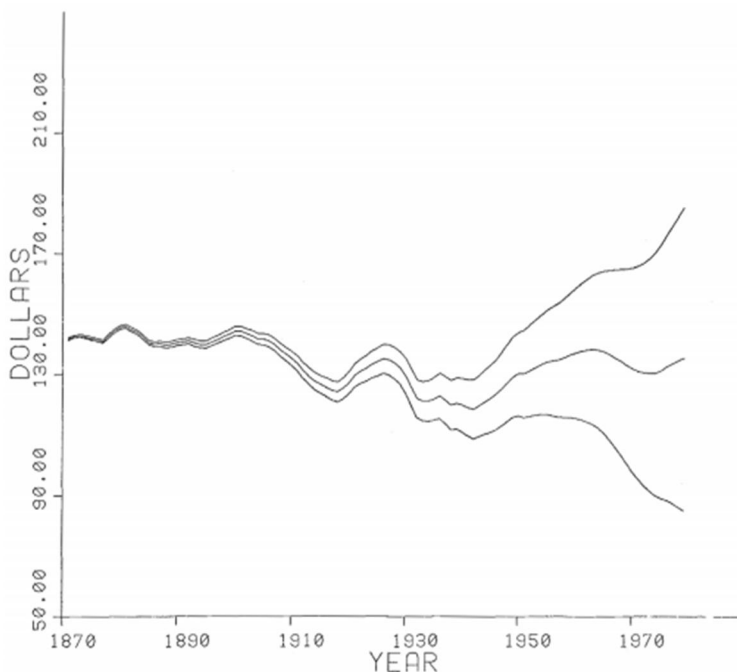

Chart 1: alternative measures of p_t^*, obtained from different "terminal value": 1871-1979 (Source: Shiller, 1981, pp. 425)

From equation (3) it can be observed that, in the efficient markets model, price p_t price of an asset at time t (or an equity portfolio represented by an index) is the expected value of p_t^*, the ex-post price of assets (or fundamental value), conditional on information available at time

t. This means that p_t is an estimate of the fundamental p_t^*, so every movement of current prices is originated from new information about the fundamental value of the asset p_t^*.

From the indicated model of efficient markets derives the relation $p_t^* = p_t + u_t$, where u_t is the error resulting from the estimate of the price ex-post, as defined by the previous report $u_t = p_t^* - p_t$. For the best possible estimate, it is necessary that the error u_t is independent from any variable information available at time *t*; if this were also significantly related only to one or the other, there would be a chance to improve the accuracy of the estimate, which then would not be optimal. However, for the initial assumption in (1) also p_t current price is to be considered information at time *t* and p_t has to be independent from the error. Since p_t and u_t are not correlated, for the principle according to which the variance of the sum of two independent variables is the sum of the variance of the individual summands, from the previous equation it is possible to state that $\text{Var}(p_t^*) = \text{Var}(p_t) + \text{Var}(u_t)$.

From this equation, since the error variance cannot be negative, $\text{Var}(u_t) \geq 0$, we get the constraint of the volatility of market prices in an efficient market model, for which the $\text{Var}(p_t^*)$ $\geq \text{Var}(p_t)$. In the case in which the constraint is violated, the stock price will systematically overestimate the value of the fundamental.

3.1.2 Shiller's Empirical analysis

For the empirical analysis, Shiller (1981) considered as an indicator of the market price the Standard and Poor's Composite Stock Price Index and the Dow Jones Industrial Average (discounted by the factor proportional to the exponential growth in the long run) in the years 1871 -1979, from which is obtained p_t^* as the present value of dividends subsequent to the year of analysis *t*, calculated as previously indicated. It can be observed that the value of p_t^*, path in a time graph, is oriented in a stable trend; on the contrary, the index swings around this trend. For this, the stability of the present value of future dividends suggests the presence of excessive volatility of market indices compared to the current value obtained from the efficient market model.
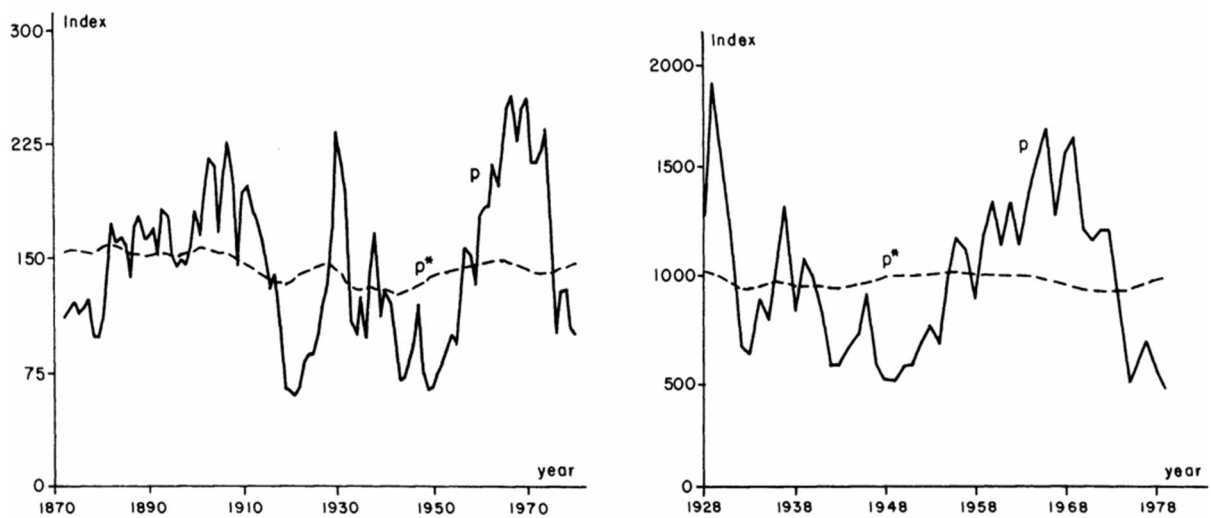
Chart 2: Real S&P500 and Real Dow Jones (solid line) compared to p_t^* (dotted line), respectively, for the periods 1871-1979 and 1928-1979 (Source: Shiller, 1981, pp. 422)

The analysis of Shiller (1981) received different forms of criticism about its validity. The first problem highlighted concerning the taking stationarity of dividends and prices of securities. For Marsh and Merton (1986), dividends do not need to "follow" a trend, even if the resulting gains do, since the issue and repurchase of shares move away dividends from randomly trend. Also, if the business managers use the dividends to provide a lower pay-out by the company's activities, it will be expected that the prices of the title vary faster than dividends; This phenomenon of "dividend smoothing" by maintaining the distribution of dividends equal to earnings per share, would create instability in prices with higher volatility than current values.

Another criticism argued that the theory of efficient markets suggests far more complex relationships than a model of expected value in which the discount factor is assumed constant in time. For example, it is possible to match the discount rate with interest rates, discounting the present value of real dividends of the index of market with interest rates in a year, adding them to a risk premium equal to the geometric mean of interest rate total at one year.

However, from the empirical analysis, variables of interest rates in the current value formula are not able to promote the model of efficient markets, since the current price remains more volatile than the current value, especially for the second half of the 20th century. Moreover, such changes in the time assumed in the present value seem to have a certain resemblance to the price changes. An alternative approach to make variable the discount factor

is formulated using the intertemporal marginal rate of substitution for consumption, consider some models of the financial markets of the 1970's. Grossman and Shiller (1981) have traced this pattern in a graph in which the essential assumption is that of a representative individual and relates to the consumption of non-durable goods and services per capita, taken by the US National Income and Product Accounts, with an aversion to risk ratio of 3.

$$P_{c,t}^* = \sum_{r=t+1}^{\infty} \left(\frac{C_t}{C_T}\right)^3 D_T$$

Even in this case, the model has only week relations with the current prices, which do not appear volatile enough to justify the movements in prices, less than an exaggeratedly high aversion coefficient, much more the coefficient 3 used by Grossman and Shiller (1981). Also, forcing a certain similarity between the current price and current value, it is possible to notice that the latter has a peak in 1929 and a fall in 1933, in line with the current prices. This trend is linked to the performance in consumption, which reached a peak in 1929 and then fall in 1933, as if people had perfect foresight to the impending depression. However, this latter fact is quite unlikely, because in that case the current price should exactly follow the trend of the current value. The discount factor just considered, despite present some movements in common with the current prices, does not justify the price volatility. Indeed, Shiller (1982) has shown that the theoretical model implies a lower limit on the volatility of the marginal rate of substitution that is, on the basis of American data, much higher than what was observed, less than an aversion to too high risk to be real.
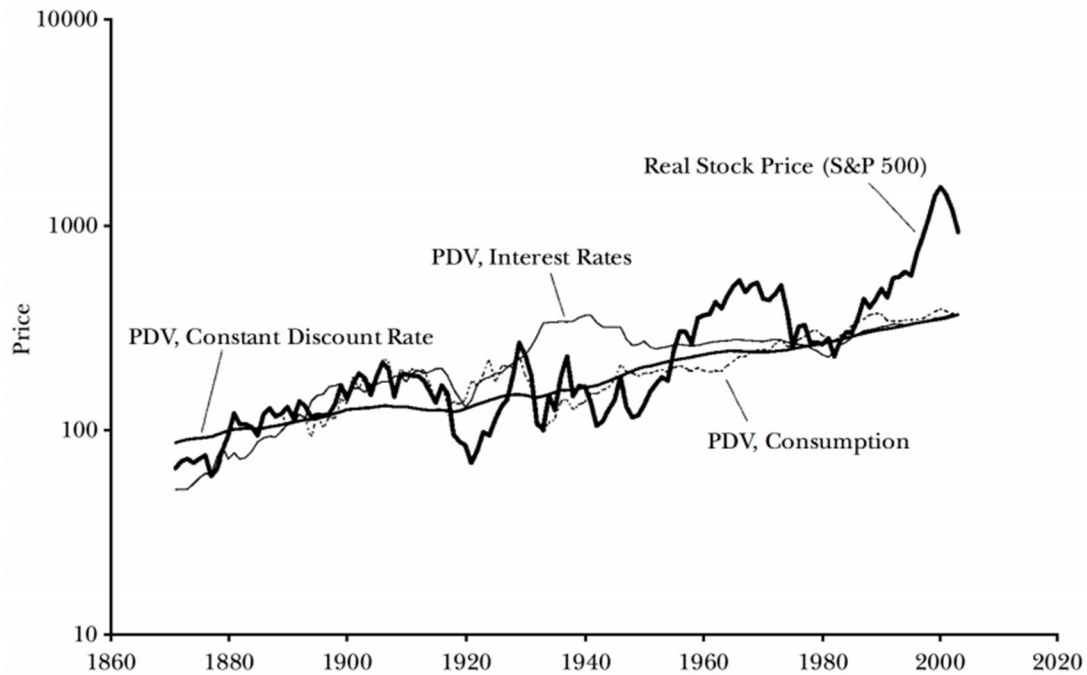
Chart 3 S&P 500: Current Prices and Values of Dividend (in real terms) (Source: Shiller, 2003)

Chart 3 is an extension of the original model of Shiller (1981) for the S&P 500 index, with data updated to 2003, in which were included the discussed present value of dividends. The dark line represents the S&P500 for January of the year observed, while the less dark line (PDV, Constant Discount Rate) represents the present value of the real dividends, discounted for a constant value equal to the geometric mean of the whole real returns sample, i.e. 6.61%. Dividends subsequent to 2002 are assumed equal to the dividends of 2002 multiplied by 1.25 (in order to correct the lowest pay-out) with a growth factor equal to the geometric mean of the historical growth rates for dividends, of 1.11%. The thin line (PDV, Interest Rates) represents the discounted present value for interest rates, from which the above conclusions are. The same thing applies to the dotted line, equal to the graphic by Grossman and Shiller (1981) of the present value of real dividends discounted by the marginal rate of substitution in consumption. The actual values are obtained from the nominal values divided by the index of consumer prices of the months previous January of the period considered.

Conclusion

For a long time, the study of finance was based on the dominant paradigm of neoclassical or traditional finance. Traditional finance is built on a number of key pillars, including the Expected Utility theory and the hypothesis of efficient markets, and got the peak of its success in academic and professional settings around 1970. Shortly after this certainty it is suddenly being questioned. The first works that highlight the existence of anomalous phenomena have been published: the traditional finance is proved to be unprepared to understand and to furnish a satisfactory explanation. Initially many of these works are criticized by neoclassical scholars, but the evidence of existing anomalies is becoming stronger. At this moment stands a new line of research: Behavioural Finance. It is a strongly empirical and arises from the application to the financial world of behavioural principles from psychology, sociology, and anthropology. Behavioural Finance can be defined as the science that studies the functioning of markets and the behaviour of the operators using its knowledge and tools of human sciences to gain insight as realistic as possible of the complex financial world. For this, a good definition is provided by Richard Thaler (1993) when he states that Behavioural Finance is nothing but an open-minded finance. This new approach has a large theoretical apparatus, consisting of a series of psychological principles derived experimentally. Among these the fundamental pillar is the Prospect Theory, formulated by Kahneman and Tversky in 1979 as opposed to the Expected Utility theory, which has as its central object the theme of loss aversion.

Kahneman and Tversky (1974) are also the first to illustrate the "heuristics biases" or heuristics, developed later by various authors. Heuristics are decision-making methods based on rapid and simple rules rather than on a logical and rational mechanism. Psychologically, when the number and frequency of information grows, the brain tries of "shortcuts" that can reduce the data processing time in order to take a decision, however. Behavioural Finance lays bare the mistakes we make in investment decisions, and also shows that errors are not random, but are persistent, systematic and potentially general: everybody can be wrong, in the same way, in the same direction. Behavioural Finance cannot teach us to become rational, but it can help us learn more about ourselves, the way we reason and function, and the situations in which we are more inclined to fall into error.

In the works analysed, the main theories for and against the hypothesis of informational efficiency of financial markets have been observed. In some cases, there is evidence to say that market players do not always seem to identify with the perfectly rational homo economicus envisaged by the classical theory. Behavioural finance treated here, certainly represents a more "real" approach to the theory of efficient markets, as opposed to traditional economic models. A famous quote by Kenneth Boulding (1950) "Mathematics brought rigor to Economics. Unfortunately, it also brought mortis" is exemplary to express this concept. Behavioural finance has certainly brought a new wave of fervour, with the use of non-conventional originally sciences, in order to explain economic behaviour in the markets. However, this is not in a position to "develop" the economy, correcting the weaknesses and defects; rather, it stands as an "antagonist" with respect to the methodological classic approach, in a complementary manner to better understand the workings of the financial markets.

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