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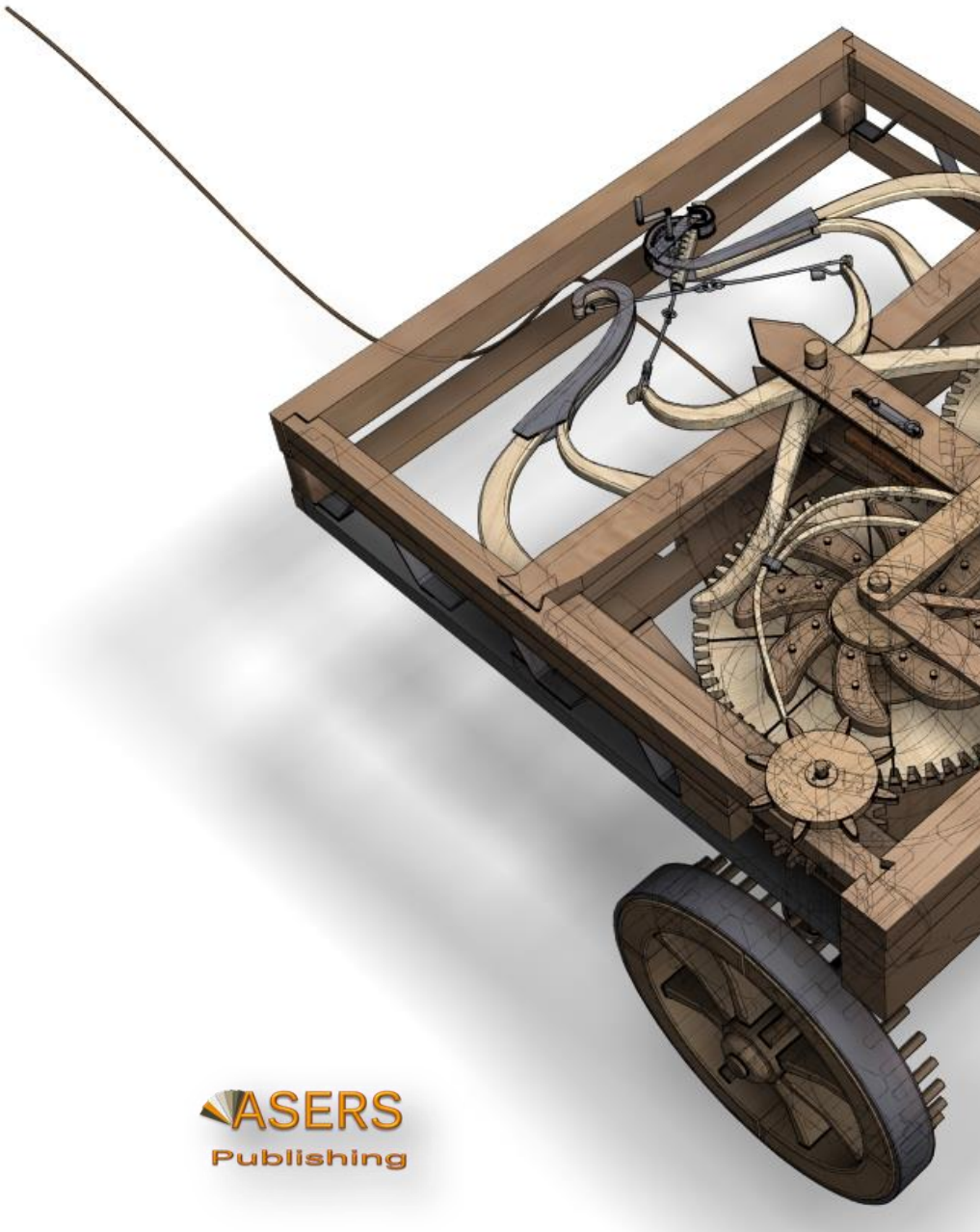

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Theoretical and Practical Research in Economic Fields

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BOUNDED RATIONALITY: PSYCHOLOGY, ECONOMICS AND THE FINANCIAL CRISES

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Abstract:
This contribution focuses on the concept of bounded rationality, highlighting the role of psychology in the economic decisions. The work analyzes Simon's approach and his notion of bounded rationality as procedural rationality. Moreover, it examines some major contributions of behavioral economics concerning cognitive biases, stressing the importance of the institutional structure in the decision process. The paper also surveys the literature of behavioral finance which has become fashionable in explaining the anomalies of financial markets, pointing out also its limits.

Keywords: Bounded rationality, rational choice, behavioral economics, behavioral finance, risk aversion.

JEL Classification: C60, B52, D81, D83.

1. Introduction

The present work criticizes the classical theory of rational choice pointing out its failures, highlighting the approach that seeks to combine economics and psychology. In particular, this contribution first analyzes the concept of bounded rationality devised by Herbert Simon. In Simon's view the rationality of the individual is bounded, since the quality of information used is poor and the cognitive capacity of the individual is limited. So the individual can make decisions that appear irrational from the perspective of conventional economic wisdom. However, these decisions are typically the right ones for the individual making them. Moreover, the paper analyzes the approach of behavioral economics which has grown in importance since the seventies.

This approach marks a return to reality from the rational optimizing model as the only framework for economics, and it also underlines that the human actions are heavily influenced by frames of reference. Thus behavioral economics maintains that institutional structure that individuals have is the basic framework for all of our economic decisions. Finally, the work refers to the literature of behavioral finance which has become widespread in explaining the behavior and the anomalies of financial markets and its crises, pointing out also its limits.

2. 'Perfect' rationality and expected utility theory

Rationality in neoclassical economics is represented by perfect rationality and it is interpreted in terms of consistency not of substance. The agents are rational if they have a coherent criterion of choice. The consistency of the choices implies that the agents are represented by a system of preference. Economics describes the choice as a rational process driven by a single cognitive process that includes the principles of the theory of rational choice and it orders the decisions on the basis of their subjective expected utility. In this view the individual has a complete knowledge and is fully rational, while his economic choices, guided by his perfect rationality, are self-contained in the economic sphere without affecting other aspects, such as the emotions, or being influenced by the environment[33].

2.1. The expected utility theory

A cornerstone of the classical theory of rational choice is the expected utility theory, which deals with the analysis of choices among risky alternatives.

[33] Hogarth and Reder (1986) argue that the paradigm of rational choice provides economics with a unity that is lacking in psychology.

Von Neumann and Morgenstern (1944) proposed their analysis of choice under uncertainty, which depends on strong assumptions of a psychological nature. The rationality is represented by the maximization of the expected utility that is a criterion that facilitates choice under risk.

According to von Neumann and Morgenstern, individuals generally move in the reality following predetermined patterns of behavior, at the base of which there is the assumption that they always prefer to have a greater wealth than less. The theory studies the preferences underlying consumer behavior under risk, i.e. when the subject is asked to make a decision without knowing with certainty which *ex ante* state of the world will happen, but he knows the probability distribution, that is, it is known to him a list of possible events, each of which he associates a probability of occurrence. This theory assumes that each individual has stable and consistent preferences, and that he makes decisions based on the principle of maximization of subjective expected utility. So given a set of options and beliefs expressed in probabilistic terms, it is assumed that the individual maximizes the expected value of a utility function u(.). The individual uses probability estimates and utility values as elements of calculation to maximize his expected utility function. Thus he evaluates the relevant probabilities and utilities on the basis of his personal opinion but also using all relevant information available.

Von Neumann and Morgenstern have proposed a well-known theorem in which they make the construction of an expected utility function possible. Any individual acting to maximize the expectation of a function u() will obey to four axioms, which are: completeness, transitivity, continuity, and independence[34]. The first two axioms, completeness and transitivity, require respectively that an individual has well defined preferences, which are therefore complete, and that preference is consistent across any three options, so the consistency requirement reminds us that intransitive preferences lead to irrational behavior.

The von Neumann-Morgenstern theorem is also based on a third axiom of continuity which states that the preferences of rational agents are ordered and without points of discontinuity. This axiom implies that for each P, Q, R ∈ **ı**, if the lottery P is preferred to Q and Q to R, then exist $\alpha, \beta \in (0,1)$ such that you can construct a linear combination of P and R for which

$$\alpha P + (1-\alpha)\, R \succ Q \succ \beta P + (1-\beta) R$$

The fourth axiom of independence is crucial and it assumes that a preference holds independently of the possibility of another outcome. For each P, Q, R ∈ **ı**, if P ≻ Q ≻ R, and for each α ∈ (0,1)

$$P \gtrsim Q \Leftrightarrow \alpha P + (1-\alpha)\, R \gtrsim \alpha Q + (1-\alpha) R$$

The expected utility theory has been generally accepted as a normative model of rational choice, defining which decisions are rational. If an individual does not maximize his expected utility he is designed to violate in his choices some precise axiomatic principles, which are rationally binding. This theory has also been applied as a descriptive model of economic behavior (Friedman and Savage, 1948; Arrow, 1971) so as to constitute an important reference model for economic theory. Thus the standard idea of rationality in economics is represented by the maximization of subjective expected utility, which is "a combination of von Neumann-Morgenstern preferences and a Bayesian belief structure" (Kahneman, 2003, p.163).

[34] The expected utility function can take three forms: is concave when describing the preferences of a risk averse individual; it is convex type when describing the preferences of an individual willing to risk; it is linear when describing the preferences of a risk-neutral individual. In the von Neumann-Morgenstern framework, we can define individual's attitudes towards risk without making any prior assumptions about his behavior.

3. Psychology and economics: a challenging relationship

During the fifties there have been important explorations along the boundaries between economics and psychology. In particular, experimental psychology, concerned with the study of actual behavior and aware of the complexity of choices, had highlighted the systematic (and unconscious) divergence of human behavior from the postulates of economic rationality. Some economists using experimental results questioned the validity of the classical model of rational choice (Simon, 1959). Thus a new line of research, called behavioral economics, started to be developed, trying to relate psychological factors to economic behavior (Rabin, 1998). One important contribution came from Herbert Simon's approach that developed the notion of bounded rationality and the problem solving. Bounded rationality, in particular, depends – according to Simon (1972) – on the limits of attentive and computational capacity. Thus, he gave start to an approach based on the heuristics that are interpreted as a trade-off between the limits of the human mind and the computing performance required by complex problems. Simon's concept of bounded rationality can be interpreted – according to Kahneman (2003) – as defining a realistic normative standard for an organism with a finite mind. Simon essentially criticized – on the basis of analysis conducted on the field – the lack of realism of the neoclassical economic theory based on the assumption of full rationality. Another major contribution came from the pioneering experimental studies of Allais (1953), which have given a boost to the cognitive economic approach. Allais was investigating on the question if preferences are consistent with each other and with the axioms of rational choices. Allais' studies demonstrated that preferences of individuals violate expected utility theory, so he proved the systematic discrepancy between the predictions of traditional decision theory and actual behavior. The results of laboratory experiments conducted by Allais have shown that individuals chose inconsistently and that they preferred solutions which did not maximize the expected utility. In this way Allais has demonstrated that the axiomatic definition of rationality did not allow describing or even predicting economic decisions[35].

Later, Ellsberg (1961) identified another paradox. He demonstrated another type of inconsistency in preferences, showing that individuals prefer to bet on a lottery with a chance of obtaining a win already known that on a lottery with ambiguous results. This aversion to uncertainty (ambiguity) of the individual is completely ignored in the expected utility model from a descriptive point of view, while is not considered acceptable from a normative point of view.

Other challenges to utility theory and to the inconsistency in preferences came from framing effects by Tversky and Kahneman (1981).

3.1. Bounded rationality

Herbert Simon[36] proposed the idea of bounded rationality as an alternative basis for the mathematical modeling of decision making. Simon has coined the term 'bounded rationality' in *Models of Man* (1957). In his view, rationality of individuals is limited by the information they have, the cognitive limitations of their minds, and the finite amount of time they have to make decisions. Bounded rationality expresses the idea of the practical impossibility (not of the logical impossibility) of exercise of perfect (or 'global') rationality (Simon, 1955). Simon argues that most people are only partly rational while are emotional/irrational in the remaining part of their actions. He maintains that, although the classical theory with its assumptions of rationality is a powerful and useful tool, it fails to include some of the central problems of conflict and dynamics which economics has become more and more concerned with (Simon, 1959, p.255). Simon identifies a variety of ways to assume limits of rationality such as risk and uncertainty, incomplete information about alternatives, complexity (1972, pp.163-164). Furthermore, he asserts that an individual who wants to behave rationally must consider not only the objective environment, but also the subjective environment (cognitive limitations); thus you need to know

[35] Maurice Allais presented in Paris, in 1952, his famous paradox to an audience composed of the best economist of his generation; among others, Kenneth Arrow, Paul Samuelson, Milton Friedman, Jacob Marschak, Oskar Morgenstern and Leonard Savage.

[36] Simon (1955, 1956, 1957, 1972, 1979, 1982, 1997).

something about the perceptual and cognitive process of this rational individual. Simon, therefore, considers the psychological theory very important to enrich the analysis for a description of the process of choice in economics. This is why he adopts the notion of procedural rationality, a concept developed within psychology (Simon, 1976, 1997), which depends on the process that generated it, so rationality is synonym of reasoning. According to Simon (1976, p.133), a search for procedural rationality is the search for computational efficiency, and a theory of procedural rationality is a theory of efficient computational procedures to find good solutions. Procedural rationality is a form of psychological rationality which constitutes the basic concept of Simon's behavioral theory (Novarese, Castellani, Di Giovinazzo, 2009; Barros, 2010, Graziano, Schilirò, 2011; Schilirò, 2012), in contrast to economic rationality, defined by Simon as 'substantive rationality'.

Another way to look at bounded rationality is that, because individuals lack the ability and resources to arrive at the optimal solution, they instead apply their rationality only after having greatly simplified the choices available. Actually, individuals face uncertainty about the future and costs in acquiring information in the present. These two factors limit the extent to which agents can make a fully rational decision. Thus – Simon claims – agents have only bounded rationality and are forced to make decisions not by 'maximization', but rather by *satisficing*, i.e. setting an aspiration level which, if achieved, they will be happy enough with, and if they don't, they try to change either their aspiration level or their decision. "The limits of human cognitive ability for discovering alternatives, calculating their outcome and making comparison may lead the decision maker to settle for some satisficing strategy" (Simon, 1982). *Satisficing* is the hypothesis that allows to the conception of diverse decision procedures and which permits rationality to operate in an open, not predetermined, space (Barros, 2010). Real-world decisions are made using fast heuristics, 'rules of thumb', that *satisfice* rather than maximize utility over the long run. Therefore agents use the heuristics to make decisions rather than a strict rigid rule of optimization. The agents do this because of the complexity of the situation, and their inability to process and compute the expected utility of every alternative action. In fact, there are limits in the attentive, mnemonic and computational capacity binding the computational load, hence the usefulness of automatic routines. Rationality is bounded by these internal constraints in the uncertain real world. Simon then relates the concept of bounded rationality to the complementary construct of procedural rationality, which is based on cognitive processes involving detailed empirical exploration and procedures ("search processes") that are translated in algorithms. This is in contrast to the notion of perfect rationality, that is based on substantive rationality, which derives choices from deductive reasoning and from a tight system of axioms; an idea of rationality that has grown up strictly within economics (Simon, 1976, 1997).

Simon does not reject completely the neoclassical theory in fact he describes a number of dimensions along which neoclassical models of perfect rationality can be made somewhat more realistic, while sticking within the vein of fairly rigorous formalization. These include: limiting what sorts of utility functions there might be, recognizing the costs of gathering and processing information, the possibility of having a "multi-valued" utility function. However, although bounded rationality offers an alternative in the form of multi-level utility, the problem with bounded rationality is that it lacks mechanisms of comparison between alternatives.

Simon's work has been followed in the research on judgment and decision making, both in economics and psychology. Two major approaches produced important insights into perception mechanisms shaping the individual's internal representation of the problem: the "heuristics and biases" program (Kahneman, Tversky (K&T), 1972; Tversky, Kahneman (T&K), 1974)[37], which has been

[37] The literature on bias evidence is quite large. As stated by Conlisk (1996, p. 672): "the evidence suggests that the magnitude and nature of the errors are themselves systematically related to economic conditions such as delibaration cost, incentives, and experience. In this sense, investigation of bounded rationality is not a departure from economic reasoning, but a needed extension of it".

fundamental to the contemporary development of behavioral economics[38]. The other approach, derived from Simon's work, is the ''fast and frugal heuristics" program (Gigerenzer, Goldstein, 1996; Todd, Gigerenzer, 2003).

Tversky and Kahneman (K&T, 1972; T&K, 1974, 1983) published a series of experiments in which they demonstrate significant deviations from the Bayesian theory of judgment under uncertainty. In a major article "Judgment under uncertainty: heuristics and biases" published in *Science* they offered a theoretical explanation about the observed deviations from perfect rationality, noting that people rely on "heuristic principles which reduce the complex tasks of assessing probabilities and predicting values to simpler judgmental operations" (T&K, 1974, p.1124). In other words, Tversky and Kahneman were arguing that heuristic short-cuts created probability judgments which deviated from statistical principles. Moreover, these authors explored the psychology of intuitive beliefs and choices and examined their bounded rationality (Kahneman, 2002, p.449). However, Tversky and Kahneman do not abandon the assumption that individuals are intelligent and intentional in making decisions, but they assume systematic and specific biases that move away the judgment from the perfect rationality of individuals. They highlighted that "failures" of perfect rationality depend on the specific ways in which people select and process the information mentally. Kahneman and Tversky (K&T, 1979, 1984; T&K, 1981, 1986) articulated a direct challenge to the rationality assumption itself, based on experimental demonstrations in which preferences were affected predictably by the framing of decision problems, or by the procedure used to elicit preferences[39]. One major conclusion of this alternative approach is that the susceptibility of people to framing effects violates a fundamental assumption of invariance. Kahneman and Tversky (1979, 1984) also argued that any individual has a deformation of the probability, which is different between gains and losses and, moreover, the individual has aversion to losses. A loss, in fact, is more weighted by a psychological point of view than a gain. Consequently, taking into account framing effects, aspects like loss-aversion, money illusion, etc. become relevant in strategic decision-making, macroeconomic phenomena and financial decisions, so the model of choice based on perfect rationality with its underlying expected utility theory fails as an adequate descriptive model of choice under risk[40].

Yet, critics have pointed out that behavioral economics is not a unified theory, but it is instead a collection of tools and ideas. This is true. But this is also true of neoclassical economics. However, as Kahneman admitted (2003, p.166), a real problem in economic theory is that models must satisfy the constraint of tractability when the assumptions are set forth. So the models can become complex, but the number of parameters that can be added is small. In addition, theoretical innovation in behavioral economics tends to be noncumulative. Despite this, one of the goals of behavioral economics is to develop better tools, but also normative rules that drive choice in desired directions (Camerer and Loewenstein, 2003; Shiller, 2005).

The other approach, derived from Simon's work, is the ''fast and frugal heuristics" program (Gigenzer, and Goldstein, 1996; Goldstein and Gigerenzer, 2002; Todd and Gigerenzer, 2003), that is in contrast to the theoretical position of Tversky and Kahneman and the theoretical strands of behavioral economics which, showing the distortions of judgment and choice defined as cognitive biases, highlight the negative effects and the errors that these heuristics lead in the behavior and choices of individuals. Fast and frugal heuristics refer to simple, task-specific decision strategies that are part of a decision maker's repertoire of cognitive strategies for solving judgment and decision tasks. Unlike many decision-making models in the behavioral sciences, models of fast and frugal heuristics describe not only the outcome of the decision-making process but also the process itself. Studies on fast and frugal heuristics include (a) the use of analytical methods and simulation studies to explore when and why heuristics

[38] Behavioral economics aims at increasing the realism of the psychological underpinnings of economics analysis for generating theoretical insights, making better predictions and suggesting better policy (Camerer and Loewenstein, 2003).

[39] In their 'Prospect theory' Tversky and Kahneman have shown experimentally the presence of inconsistent judgments and choices by an individual facing the same problem presented in different frames ('invariance of failures'). It follows that the frame, or the context of choice, *coeteris paribus*, helps to determine a different behavior.

[40] However, according to Gennaioli and Shleifer (2010, p.1399): "Although Kahneman and Tversky's heuristics and biases program has survived substantial experimental scrutiny, models of heuristics have proved elusive".

perform well; and (b) experimental and observational studies to explore whether and when people actually use fast and frugal heuristics. Following Simon's notion of *satisficing*, Gigenzer and Goldstein (1996), for example, have proposed a family of algorithms based on a simple psychological mechanism: one-reason decision making. These fast and frugal algorithms violate fundamental tenets of classical rationality: they neither look up nor integrate all information (Gigenzer and Goldstein, 1996). The heuristics are determined by a trade-off between the limits of the human mind and the computing performance required by complex problems[41]. Each individual is a complex system operating in a complex environment interconnected by a system of relationships that change dynamically over time the choices that each individual operates are choices with limited rationality. In the same way, the companies of all kinds are complex systems composed of individuals or complexing agents their collective behavior is in turn influenced by the bounded rationality of its components, making them agents bounded rationality. These considerations (Gigerenzer, Hertwig and Pachur, 2011) give more confirmation that the understanding of the mechanisms underlying the behavior of individuals, agents are critical to the operation of the firm. The use and study of heuristics is therefore crucial to understand and operate in these uncertain, dynamic and highly interconnected contexts. At the same time the version of bounded rationality, coupled with insights from evolutionary psychology, put forward by Gigerenzer and Selten (2001) and by Todd and Gigerenzer (2003), gives a different grasp of the functional role of emotions within the human decision machinery.

4. Behavioral finance

To understand financial markets, traditional finance paradigm use models in which agents are perfectly or fully rational. Agents' rationality means that when they receive new information, agents update their beliefs correctly, in the manner described by Bayes' law. Moreover, given their beliefs, agents make choice that are normatively acceptable, in the sense that they are consistent with the notion of subjective expected utility, implying a preference-maximizing choice, so financial decisions for the rational agent are based on the hypothesis that they calculate their rational advantage and act consistently with that.

According to Simon's bounded rationality, individuals may not have the knowledge base to make ideal choices in finance-related matters. Following this view, financial decision making can be improved by providing individuals with better quality information presented in a non-complex fashion and an institutional environment conducive to good decisions.

Yet, research in psychology have supported the view that emotional reactions to situations involving uncertainty or futurity often differ sharply from cognitive assessments of those situations, and that when such differences occur, it is often the emotional reactions that determine behavior.

From the seventies onwards there has been an increasing interest towards psychological and sociological aspects in the analysis of financial behavior. Then there has been the development of a new branch of finance: behavioral finance, which in itself combines aspects of cognitive psychology and financial theories in the strict sense. Behavioral finance argues that some financial phenomena can plausibly be understood using models in which some agents are not fully rational. One of the building blocks of behavioral finance is psychology. Then behavioral finance has become the study of the influence of psychology on the behavior of financial investors and the subsequent effect on markets.

Behavioral finance is of interest because it helps explain why and how markets might be inefficient. In practice this new approach seeks to explain the so-called financial market "anomalies" by analyzing the deviation of financial agents' behavior from full rationality and optimum choices. A way to overcome the limited or bounded rationality of the agents, also in financial markets, is to make use of rules of thumb. But, as highlighted by Tversky and Kahneman (1974), «people rely on a limited number

[41] Empirical literature has indicated that humans use fast and frugal heuristics especially when under time pressure, when information search is costly or when information has to be retrieved from memory. Gigerenzer and Brighton (2009) maintain that *Homo heuristicus* has a biased mind and ignores part of the available information, yet a biased mind can handle uncertainty more efficiently and robustlythan an unbiased mind.

of heuristic principles which reduce the complex tasks of assessing probabilities and predicting values to simpler judgmental operations. In general, these heuristics are quite useful, but sometimes they lead to severe and systematic errors» (Tversky and Kahneman, 1974, p. 1124)[42]. Thus, the adoption of heuristics by individuals can be necessary to solve the problems of everyday life, but in the financial sector it can lead to biases which have proved very expensive. However, behavioral finance make use of a set of tools that include susceptibility to frames and other cognitive errors, so that the institutional structure becomes relevant, but also tools that imply varying attitudes toward risk, aversion to regret and imperfect self-control.

4.1. Behavioral finance: anomalies and biases

In the reality of financial markets the fact that the price of a stock should coincide with its fundamental value seems to be more the exception than the rule. The "anomalies" in the behavior of prices yields, in contrast to the hypothesis of efficient markets, are numerous and show that the securities are by no means in line with their fundamentals.

The efficient market theory (Fama, 1970, 1991) asserts that financial markets are informationally efficient, that is markets are efficient in the sense of information if at all times the stock prices fully and correctly reflect all the available information[43]. This theory rests on the efficient market hypothesis (EMH), which is based on three theoretical assumptions: i) market agents are perfectly rational and are able to value any security rationally; ii) even if there are some investors who are not rational, their trading activities will either cancel out one another or will be arbitraged away by rational investors; iii) market agents have well defined subjective utility functions which they will maximize. Consequently, the theoretical foundation of the EMH is the subjective utility theory. Thus, according the EMH, no investment strategy can earn average returns greater that are warrented for its risk (Barberis and Thaler, 2002).

Kahneman and Tversky (1973) had already noticed that investors systematically violate Bayes' rule and other maxims of probability theory in predicting uncertain outcomes. In forecasting future uncertain events investors usually focus on recent history and pay less attention to the possibility that such short history could be determined by chance[44].

In the eighties and nineties there have been a series of contributions in behavioral finance which have proposed models departing from economic rationality in specific contexts that explain a family of anomalies. These models do not abandon completely the rationality model as the basic framework, but they focus on some particular deviation explaining the anomalies. Behavioral finance, in fact, has argued that some features of asset prices are most plausibly interpreted as deviations from fundamental value, and that these deviations are brought about by the presence of traders that are not fully rational. For instance, the theory of market efficiency has been challenged by the discovery of some anomalies that would produce excess returns. De Bondt and Thaler (1985) in their seminal paper "Does the stock market overreact?", discovered that people systematically overreacting to unexpected and dramatic news events results in substantial inefficiencies in the stock market. These authors have shown that bonds, characterized by particularly high yields (so-called winners), record in the aftermath the worst yield and vice versa. This depends on investors' overreaction to an event. Since investors count on the

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[42] Tversky and Kahneman (1973) introduced the availability heuristic as "a judgmental heuristic in which a person evaluates the frequency of classes or the probability of events by availability, i.e. by the ease with which relevant instances come to mind." The reliance on the availability heuristic leads to systematic biases.

[43] According to the efficient market hypothesis, "it was generally believed that securities markets were extremely efficient in reflecting information about individual stocks and about the stock market as a whole. The hypothesis is associated with the idea of a "random walk", which is a term loosely used in the finance literature to characterize a price series where all subsequent price changes represent random departures from previous prices. The logic of the random walk idea is that if the flow of information is unimpeded and information is immediately reflected in stock prices, then tomorrow's price change will reflect only tomorrow's news and will be independent of the price changes today. But news is by definition unpredictable, and, thus, resulting price changes must be unpredictable and random" (Malkiel, 2003, p.59).

[44] In a later paper Kahneman and Thaler (2006) reviewing a wide empirical literature in behavioral economics noticed that since often forecasts are systematically biased, then choices may systematically fail to maximize utility.

representative heuristic, they become too optimistic about recent winners and too pessimistic about recent losers. However, over the time the investors realize the error and correct their assessments causing a reversal of returns[45]. De Bondt and Thaler (1985) made use in their paper of the notion of mental accounting which is the set of cognitive operations used by individuals and households to organize, evaluate and keep track of financial activities. Odean (1998, 1999), instead, has found that investors tend to overestimate their ability and also the precision of their own private information. Odean finds that overconfident traders trade too much, lower their expected utility and increase volatility in the markets. So he has designed a stock market in which all traders are overconfident; these traders do not properly optimize their expected utility, which are therefore lower than if the traders were rational. A consequence of this behavior is that overconfident traders hold underdiversified portfolios (Odean, 1998, p. 1912). At the same time, Barberis, Shleifer and Vishny (1998), adopting a quasi-Bayesian approach[46], present a model of investor sentiment that displays under reaction of stock prices to news such as earnings announcements in the short run and overreaction of stock prices to a series of good or bad news in the long run. Another important aspect highlighted in behavioral finance is loss-aversion. Bernatzi and Thaler (1995) presented a model of a stock market in which investors are assumed to be "loss-averse", meaning that they are distinctly more sensitive to losses than to gains. In this model agents are taking into account of interdependencies between decisions. Another assumption of the model is that even long-term investors are assumed to evaluate their portfolios frequently. Thus they define the combination of these two assumptions "myopic loss-aversion". The aim of this contribution is to explain the equity premium puzzle by myopic loss-aversion, adopting an alternative preference structure to the standard expected utility-maximizing paradigm (Bernatzi and Thaler, 1995, p.90).

As we mentioned in the section 2.2, Kahneman and Tversky (1979) in their prospect theory, acknowledging the bounded rationality of individuals, offered a descriptive model of risky choice in which the carries of utility are not states of wealth, but gains and losses relative to a neutral reference point. The most distinctive predictions of the theory arise from a property of preferences called loss-aversion (Kahneman, 2003, p.164), which indicates the disparity the strong aversion to losses relative to a reference point and the weaker desire for gains of equivalent magnitude. In other words, the loss-aversion of an individual is related to the fact that the sensation of loss relative to status quo and other reference points looms very large relatively to gains. This sensation of loss has been identified and emphasized in a great deal of experimental work, thus loss-aversion proves to be more realistic than the standard continuous, concave, utility function over wealth (Rabin, 2002a). Thaler (1980) was the first to extend the idea of loss-aversion to riskless choice. He used loss-aversion to explain the endowment effect – the discrepancy between willingness-to-pay and willingness-to-accept for the same good. Also Kahneman, Knetsch and Thaler (1991) analyzed the topic of loss-aversion[47], exploring other implications. They carried out a significant experiment based on the "endowment effect" where these authors demonstrated that the individuals feel a great sorrow when they lose the objects they possess, more than the pleasure would cause them to acquire those same objects, if they do not already possess them. So the "endowment effect" is an anomaly that causes a *statu quo bias* (a preference for the current state that biases the individual against both buying and selling his object). The "endowment effect" is connected to the particularly pervasive phenomenon of loss-aversion, for which the disutility of a loss is greater than the utility of a win of the same size.

Loss-aversion contributes to stickiness in markets, because loss-averse agents are much less prone to exchanges than final-states agents (Kahneman, 2003). Thus in the field of behavioral finance the loss-aversion appears to manifest itself in the investor behavior as an unwillingness to sell assets or

[45] In a subsequent article De Bondt and Thaler (1987) provide additional evidence that supports the overreaction hypothesis.

[46] A "quasi-Bayesian" approach assumes that people misspecify a set of hypotheses, or enconde new evidence incorrectly, but otherwise use Bayes' rule. See, for instance, the model of Rabin (2002) on the "law of small numbers".

[47] The loss-aversion is a core aspect of agent's reference-based preferences and it is related to the fact that the sensation of loss relative to status quo and other reference points looms very large relatively to gains. This sensation of loss has been identified and emphasized in a great deal of experimental work (Rabin, 2002a, p.9).

other securities, if doing so forces the investor to achieve a nominal loss. This loss-aversion can help to explain why housing market prices do not adjust downwards during periods of low demand with the relative drying up of sales since the agents are unwilling to accept losses relative to an existing reference price (Genesove and Mayer, 2001)[48]. Barberis and Huang (2008) also provided a model incorporating loss aversion and framing into asset pricing to understand the equity premium puzzle.

Furthermore, Thaler and Shefrin (1981)[49], who gave major contributions to behavioral finance, presented their behavioral life-cycle theory arguing that economists who wish to analyze the consumption-saving decision must address the bounded rationality and impatience of consumers. In their models self-control is an acknowledged problem[50]. The behavioral-life cycle theory models consumers as responding to psychological limitations by adopting rules-of-thumb, such as mental accounts (as in De Bondt and Thaler, 1985), that are used to constrain the decision making of the myopic agent. Mental accounting is a useful way to describe the rules which govern gain/loss integration (Thaler, 1999). It predicts that people will spend money coming from different sources in different ways. Mental accounting stands in opposition to the standard view in economics that money is fungible.

Several criticisms have been made to behavioral finance. One is that theoretical behavioral models are somewhat as hoc and designed to explain specific stylized facts. This may be true, but these models are based on how agents actually behave, and their behaviors have been studied on extensive experimental evidence, so these models are able to explain evidence in financial markets better than traditional models. Another important criticism and often recurring is that behavioral finance presents no unified theory unlike expected utility theory maximization using rational beliefs. But the normative property of the traditional theory cannot justify its limitations; moreover behavioral finance proved to be able in helping us understanding financial phenomena (Subrahmanyam, 2008).

Conclusion

Psychology and economics have provided wide-ranging evidence and robust empirical findings that bounded rationality is crucial, so this notion represents a reference point for understanding economic behavior and economic choices. This paper argued that we can enrich our knowledge of the complex reality of financial markets through the fertile contribution of Simon' approach and of behavioral finance.

The work also examined some major contributions of behavioral finance which have highlighted failures in the traditional theory of rational investor, but also anomalies and biases in the behavior of financial markets that can lead to financial crises. A consequence of this analysis is that economics should aspire of making assumptions about human behavior as realistic as possible on a psychological level and that individuals with bounded rationality must be provided with better quality information presented in a non-complex fashion and an institutional environment conducive to good decisions, since the latter constitutes the basic framework for all economic decisions.

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[48] The literature of behavioral finance includes the lack of symmetry between decisions to acquire and maintain resources and the strong aversion to the loss of some (emotionally) valuable resources that could be completely lost.

[49] See also Thaler and Shefrin (1988) and Thaler (2003).

[50] Thaler (1981), discussed the theory of intertemporal choice and tested the model porposed in Thaler and Shefrin (1981) in which the hypothesis was that the discount rate will vary inversely with the size of the reward for which the individual must wait. This hypothesis is derived from viewing intertemporal choice as problem in self-control. In fact, waiting for a reward requires some mental effort. If this effort does not increase proportionally with the size of the rewards (if there are some fixed psychics to waiting) then the hypothesized result will be present.(Thaler, 1981, p. 202). Thaler (1981) also showed that gains and losses of different absolute magnitudes are discounted differently.

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