RATIONALITY INTERTWINDED: CLASSICAL VS INSTITUTIONAL VIEW

Roberto Ivo da Rocha Lima Filho
Universidade de São Paulo FMUSP
Rua Dr. Arnaldo, 455, Instituto Oscar Freire - 2º andar – São Paulo –SP. CEP: 01246-000
E-mail: robertoivo@usp.br
E-mail: roberto_ivo@hotmail.com

Abstract

The scope of this paper is to explore the different aspects of rationality, in a institutionalist approach , digressing about the sources that make an individual rational and its close relation to the laws of subjective probability and its "goodness of fit" to the heterodox approach. This work will however be completely detached from the traditional approach, that is, neoclassical theory, making use of some relevant authors' works in philosophy (i.e., Alfred Meele, Robert Audi) as well as statistics (i.e., Bruno de Finetti, Richard Jeffrey), resulting in a new alternative and multidisciplinary agenda to the study of methodology of economics. Recently a growing number of researches in economics are leading towards to areas which embrace the study of rationality such as psychology, neurosciences and computer science (neural network and/or fuzzy logic). The idea is not only make economics approximate to the reality, but also try to attempt a 'creation' of an ergodic theory – stable framework –, with which it can be fallen back on continuously over time, despite an ongoing changing world.

Rationality as economists know can be defined as the results we usually get when the choices are limited or scarce. Thus leads to the same line stressed by Douglas North in his work, "Dealing with a Non-Ergodic World: Institutional Economics, Property Rights, and the Global Environment", dated in 1999; where human-decision-making can be a combination of intended rational choices, supplemented by effective institutions that constrain the environment and the uncertainties of the environment. And he complements that there are artifactual structure, the latter being defined by the set of institutions, tools, and techniques that humans create when dealing with the world around them. Therefore, it is the combination of mental models that humans intrinsically possess and the artifactual structure that they create which will determine the effectiveness of human decision. Through this definition abovementioned, it is worth noting that, roughly speaking, it may suggest the representation of the two types of rationality as claimed by Meele (2004): - Epistemic and practical rationality. The former is the degree of beliefs that permeates the humans' actions (techniques) and the latter being the "what is rational to do" (according to each institution). In other words, the epistemic rationality means the rationality of cognitions (seeking the true), whereas the practical one is considered the rationality of elements (seeking to do the things that somehow satisfy desires and needs). Of course there are some conditions in order to establish what is rational or not, this is named "closure conditions" and it entails that there are a quantity of propositions which can be theoretically rational for one individual who has got rational belief or apparently good "grounds".

Key words: *Rationality, Bayesianism, Methodology of Economics*

RATIONALITY INTERTWINDED: CLASSICAL VS INSTITUTIONAL VIEW

1. INTRODUCTION:

The scope of this paper is to explore the different aspects of rationality, in a institutionalist approach , digressing about the sources that make an individual rational and its close relation to the laws of subjective probability and its "goodness of fit" to the heterodox approach. This work will however be completely detached from the traditional approach, that is, neoclassical theory, making use of some relevant authors' works in philosophy (i.e., Alfred Meele, Robert Audi) as well as statistics (i.e., Bruno de Finetti, Richard Jeffrey), resulting in a new alternative and multidisciplinary agenda to the study of methodology of economics. Recently a growing number of researches in economics are leading towards to areas which embrace the study of rationality such as psychology, neurosciences and computer science (neural network and/or fuzzy logic). The idea is not only make economics approximate to the reality, but also try to attempt a 'creation' of an ergodic theory – stable framework –, with which it can be fallen back on continuously over time, despite an ongoing changing world.

In the next section, it will be presented the nature and sources of rationality, in which individuals can rely on making their respective decisions through a system of beliefs. This fact will entail an understanding of the origins of the theory of rationality, which is closely related to the epistemic notion of knowledge. The latter will be the ground of section three, whose objective is to bridge with the theory of subjective probability, created by de Finetti's works, and its philosophical milestone. Notwithstanding some remarks will be made on modern bayesianism, outlining the mathematical foundations of the laws of probability. Problems regarding Bayesianism will be stressed in section four.

In section five, an economic view will be formulated basing on assumptions explained in previously sections and how they fit the new upcoming institutional economics. Concluding remarks will gather further comments on this approach and suggest possible future lines of works.

2. INTRODUCTION:

Rationality as economists know can be defined as the results we usually get when the choices are limited or scarce. Thus leads to the same line stressed by Douglas North in his work, "Dealing with a Non-Ergodic World: Institutional Economics, Property Rights, and the Global Environment", dated in 1999; where human-decision-making can be a combination of intended rational choices, supplemented by effective institutions that constrain the environment and the uncertainties of the environment. And he complements that there are artifactual structure, the latter being defined by the set of institutions, tools, and techniques that humans create when dealing with the world around them. Therefore, it is the combination of mental models that humans intrinsically possess and the artifactual structure that they create which will determine the effectiveness of human decision.

Through this definition abovementioned, it is worth noting that, roughly speaking, it may suggest the representation of the two types of rationality as claimed by Meele (2004): - Epistemic and practical rationality. The former is the degree of beliefs that permeates the humans' actions (techniques) and the latter being the "what is rational to do" (according to

each institution). In other words, the epistemic rationality means the rationality of cognitions (seeking the true), whereas the practical one is considered the rationality of elements (seeking to do the things that somehow satisfy desires and needs). Of course both aspects are intertwined and a decision is made by the conjunct of the two types of rationality.

The rationality of cognition and elements can be both found in Joseph Schumpeter's groundbreaking work "Theory of Economic Development" dated on 1912. The idea of an innovator entrepreneur to aiming at discovering new pathways completely out of his routine environment is concerned with his degree of belief (knowledge) and the fact that this novelty might work out and thus point to the practical rationality. That is, to conceive the "new", the entrepreneur must fight to overcome some difficulties not only within his social insertion (scepticism and/or negation regarding the novelty), but also try the "new" to be economically significant given the restricted information on it (or in some cases, no information at all, lying overall in his the intuition). As pointed by Schumpeter:

"(…) Within economic life, it must be acted as to solve all the details that must be done. Here, the success depends on the capacity to see things through a way that ex-post it might end up to be true, even though at the moment it is conceived it can not be compared, and to realize that the essential fact, leaving aside the perfunctory, that it may not demonstrate the principles that lead to that specific action." ([1985], pg.85)

The degrees of beliefs actually mean the representation of the world, which in epistemic terms, is the ground of knowledge. According to Audi (2004), the sources of rationality are perception, memory, consciousness, and reason, mostly because they do not depend on other justifications (and again, there is subtle limit among those four sources, given its enlacement). Besides, they are called sources because they are epistemically autonomous.

The first one, perception, can be thought of as a type of consciousness because an individual must be aware of an "external object". In order words, the mind recognizes the existence of an "exterior environment". However, as Audi (2004) claims, perception should be in this case characterized by the internal consciousness solely. That means what is inherent to the mind as a source of rational belief (or knowledge). And if something is unidentified by an individual, it triggers what is called a subjective response side, also part of the theoretical rationality. Memory is defined in a strict sense as a mean to remember and if an individual does remember, it requires him to be acquainted of have perceived (or mentally uphold) something – object, information, etc. Therefore it is another source of theoretical rationality. As stated previously, consciousness is a basic source of rational belief owing to the fact that is part / inside of one's mind.

In Audi's words, reason is "the source [which] seems to operate by yielding an adequate degree of understanding of the proposition in question and thereby knowledge. It does not appear to depend (positively) on any other source and is plausibly considered basic." Additionally he states that this basic knowledge stems from a noninferential source that does not depend on memory and delivers a true cognitive process. However, it must not be ruled out some inferences that also are independent from the memory capacity of remembering.

But one important fact about the sources of theoretical rationality is the coherence between one's belief and the system of beliefs, overall speaking. Because coherence is the source of justification and the latter is intrinsically associated to the knowledge, coherence must be counted as a source too. It must be pointed out its relevance because without it a belief can be heavily undermined and that is why it must be paid attention to it when constructing assumptions or theory. Another aspect of coherence is, according to Audi, the fact that indicates rationality (roughly a lead indicator) vis-à-vis one's experience. Of course

there are some conditions in order to establish what is rational or not, this is named "closure conditions" and it entails that there are a quantity of propositions which can be theoretically rational for one individual who has got rational belief or apparently good "grounds".

2.1 RATIONALITY AND ECONOMICS

What was exposed in the previous paragraph gives the basis to the so-called practical rationality, that is, a "status that can be justifiably attributed to actions on the basis of theoretical reason", according to Robert Audi. However, for economists, the definition of rationality is known as procedural and substantive, being the former the epistemic rationality whereas the latter the practical one. The substantive rationality is permeated by the works of Thomas Sargent with respect to rational expectations, which hypotheses that an individual has an utility function with their preferences and has the intention of optimizing it accordingly, given the state of nature. In other words this individual is rationally believed to know the space of probability within the economic environment he is inserted.

Simon (1981) acknowledges that this type of rationality computes the optimal response regardless of how the necessary information was utilised in the whole process. He was responsible for denominating it as substantive rationality. Another important aspect from the process of optimizing the utility function under the spectrum of substantive rationality is the fact of all individuals is supposed to maximize their preferences with the same "economic model", which, of course, leads to paradoxes. To start, this economic model is deemed to be the best among all possible models and all individuals will make use of it, as highlighted by Simonsen (pg. 530, 1989).

Another curious paradox is related to Danie Ellsberg, which was cited by Keynes is his early works, and is defined when an individual violates the expected utility hypothesis, that is, it describes an attitude of preference for known risks over unknown risks, also known as uncertainty (ambiguity) aversion. For example, people prefer to bet on an urn with 50 Red and 50 Blue balls, than in one with 100 total balls but where the number of blue or red balls is not known. This is, however, different from the risk aversion conception since it rejects types of risk based in part on measures of their certainty, not solely on their magnitude (payoff is also irrelevant). The possible explanations are:

1) Since the probabilistic information available to the decision-maker is incomplete, these attempts sometimes focus on quantifying the non-probabilistic ambiguity which the decision-maker faces. That is, these alternative approaches sometimes suppose that the agent formulates a subjective (though not necessarily Bayesian) probability for possible outcomes.

2) One such attempt is based on info-gap decision theory. The agent is told precise probabilities of some outcomes, though the practical meaning of the probability numbers is not entirely clear. For instance, in the gambles discussed above, the probability of a red ball is 30/90, which is a precise number. Nonetheless, the agent may not distinguish, intuitively, between this and, say, 30/91. No probability information whatsoever is provided regarding other outcomes, so the agent has very unclear subjective impressions of these probabilities.

3) In light of the ambiguity in the probabilities of the outcomes, the agent is unable to evaluate a precise expected utility. Consequently, a choice based on maximizing the expected utility is also impossible. The info-gap approach supposes that the agent implicitly formulates info-gap models for the subjectively uncertain probabilities. The agent then tries to

satisfy the expected utility and to maximize the robustness against uncertainty in the imprecise probabilities. This robust-satisfying approach can be developed explicitly to show that the choices of decision-makers should display precisely the preference reversal which Ellsberg observed.

4) Another possible explanation is that this type of game triggers a deceit aversion mechanism. Many humans naturally assume in real-world situations that if they are not told the probability of a certain event, it is to deceive them. People make the same decisions in the experiment that they would about related but not identical real-life problems where the experimenter would be likely to be a deceiver acting against the subject's interests. When faced with the choice between a red ball and a black ball, the probability of 30/90 is compared to the lower part of the 0/90-60/90 range (the probability of getting a black ball). The average person expects there to be fewer black balls than yellow balls because in most real-world situations, it would be to the advantage of the experimenter to put fewer black balls in the urn when offering such a gamble. On the other hand, when offered a choice between red and yellow balls and black and yellow balls, people assume that there must be fewer than 30 yellow balls as would be necessary to deceive them. When making the decision, it is quite possible that people simply forget to consider that the experimenter does not have a chance to modify the contents of the urn in between the draws. In real-life situations, even if the urn is not to be modified, people would be afraid of being deceived on that front as well.

Allais paradox, however, posed by Maurice Allais, shows an inconsistency of actual observed choices with the predictions of expected utility theory. The problem arises when comparing participants' choices in two different experiments, each of which consists of a choice between two gambles, A and B. The payoffs for each gamble in each experiment are as follows:

Experiment 1				**Experiment 2**			
Gamble 1A		***Gamble 1B***		***Gamble 2A***		***Gamble 2B***	
Winnings	*Chance*	*Winnings*	*Chance*	*Winnings*	*Chance*	*Winnings*	*Chance*
$1 million	100%	$1 million	89%	Nothing	89%	Nothing	90%
		Nothing	1%	$1 million	11%		
		$5 million	10%			$5 million	10%

Allais asserted that, presented with the choice between 1A and 1B, most people would choose 1A, and presented with the choice between 2A and 2B, most people would choose 2B. This has been borne out in various studies involving hypothetical and small monetary payoffs, and recently with health outcomes. Allais further asserted that it was reasonable to do so.

However, that the same person would choose both 1A and 2B is inconsistent with expected utility theory. Both gambles give the same outcome 89% of the time (the top row; $1 million for Gamble 1, and zero for Gamble 2), so, in expected utility, these equal outcomes should have no effect on the desirability of the gamble. If the 89% 'common consequence' is disregarded, both gambles offer the same choice; a 10% chance of getting $5 million and 1% chance of getting nothing as against an 11% chance of getting $1 million. (It may help to re-write the payoffs. 2A offers an 89% chance of winning nothing and a 11% chance of winning $1 million, where the 89% chance is irrelevant. 1B offers an 89% chance of winning $1 million, a 1% chance of winning nothing, and a 10% chance of winning $5 million, with the

89% chance of nothing disregarded. Hence, choice 1A and 2A should now clearly be seen as the same choice, and 1B and 2B as the same choice).

Allais presented his paradox as a counterexample to the independence axiom (also known as the "sure thing principle" of expected utility theory. Independence means that if an agent is indifferent between simple lotteries L1 and L2, the agent is also indifferent between L1 mixed with an arbitrary simple lottery L3 with probability p and L2 mixed with L3 with the same probability p. Violating this principle is known as the "common consequence" problem (or "common consequence" effect). The idea of the common consequence problem is that as the prize offered by L3 increases, L1 and L2 become consolation prizes, and the agent will modify preferences between the two lotteries so as to minimize risk and disappointment in case they do not win the higher prize offered by L3.

Difficulties such as this gave rise to a number of alternatives to, and generalizations of, the theory, notably including prospect theory, developed by Daniel Kahneman and Amos Tversky, weighted utility (Chew) and rank-dependent expected utility by John Quiggin. The point of these models was to allow a wider range of behavior than was consistent with expected utility theory.

Also relevant here is the framing theory by Daniel Kahneman and Amos Tversky. Identical items will result in different choices if presented to agents differently (i.e. a surgery with a 70% survival rate vs. a 30% chance of death) However, the main point Allais wishes to make, is that the independence axiom of expected utility theory may not be a necessary axiom. The independence axiom states that two identical outcomes within a gamble should be treated as irrelevant to the analysis of the gamble as a whole. However, this overlooks the notion of complementarities, the fact your choice in one part of a gamble may depend on the possible outcome in the other part of the gamble. In the above choice, 1B, there is a 1% chance of getting nothing. However, this 1% chance of getting nothing also carries with it a great sense of disappointment if you were to pick that gamble and lose, knowing you could have won with 100% certainty, if you had chosen 1A. This feeling of disappointment however, is contingent on the outcome in the other portion of the gamble (i.e. the feeling of certainty). Hence, Allais argues that it is not possible to evaluate portions of gambles or choices independently of the other choices presented, as the independence axiom requires, and thus is a poor judge of our rational action (1B cannot be valued independently of 1A as the independence or sure thing principle requires of us). We don't act irrationally when choosing 1A and 2B, rather expected utility theory is not robust enough to capture such "bounded rationality" choices that in this case arise because of complementarities. Indeed, this fact will be explored in the next section.

2.2 BOUNDED RATIONALITY

Bounded rationality is a concept based on the fact that 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. This contrasts with the concept of rationality as optimization. Another way to look at bounded rationality is that, because decision-makers lack the ability and resources to arrive at the optimal solution, they instead apply their rationality only after having greatly simplified the choices available. Thus the decision-maker is a satisfier, one seeking a satisfactory solution rather than the optimal one.

The term was coined by Herbert Simon, defining it as (Simon, pg. 502, 1979):

"Rationality is bounded when it falls short of omniscience and the failures of omniscience are largely failures of knowing all the alternatives, uncertainty about relevant exogenous events, and inability to calculate the consequences."

In "Models of Man", Simon points out that most people are only partly rational, and are in fact emotional/irrational in the remaining part of their actions. In another work, he states "boundedly" rational agents experience limits in formulating and solving complex problems and in processing (receiving, storing, retrieving, transmitting) information" (Williamson, p. 553, citing Simon). Simon describes a number of dimensions along which "classical" models of rationality can be made somewhat more realistic, while sticking within the vein of fairly rigorous formalization. These include:

1) limiting what sorts of utility functions there might be;
2) recognizing the costs of gathering and processing information;
3) the possibility of having a "vector" or "multi-valued" utility function.

Simon suggests that economic agents employ the use of heuristics to make decisions rather than a strict rigid rule of optimization. They do this because of the complexity of the situation, and their inability to process and compute the expected utility of every alternative action. Deliberation costs might be high and there are often other, concurrent economic activities also requiring decisions. However, Gerd Gigerenzer argues that most decision theorists who have discussed bounded rationality have not really followed Simon's ideas about it. Rather, they have either considered how people's decisions might be made sub-optimal by the limitations of human rationality, or have constructed elaborate optimising models of how people might cope with their inability to optimize. Gigerenzer instead proposes to examine simple alternatives to a full rationality analysis as a mechanism for decision making, and he and his colleagues have shown that such simple heuristics frequently lead to better decisions than the theoretically optimal procedure.

2.2.1 SIMON VERSUS SARGENT – DIFFICULTIES IN MODELLING RATIONALITY

Simon argues that substantive rationality has a system that:

"(...) adapts to an outer environment, subject only to the goal, defined by its inner environment. To predict its behaviour we need information about the outer environment and the goal, but we need no information about the process used to compute the optimal quantity".

In other words, substantive rationality seen as bounded rationality, as mention before, may advocate the process of optimizing, which, according to Simon, may not embrace all states of information in the world. This misperception would not, however, invalidate this type of rationality. Another point is the fact that bounded rationality can be adjusted according to the transformations of the real world, leading to a learning process.

In this respect, the definition above goes against the one proposed by Sargent (1993) because, as previously cited, he considers people as artificial agents, whose decision making process is similar to the one used by economists (econometricians), that is, its overall behaviour are under the same quantitative principles used to model them, or alternatively, the agents must be as close as possible to the real world. Since, as Sargent himself put (2003, pg.3): "Ironically when we economists make the people in our models more 'bounded' in their rationality and more diverse in their understanding of the environment, we must be smarter, because our models become larger and more demanding mathematically and econometrically". Sargent then faces two serious problem: 1) The model does not allow for

heterogeneity of the agents; 2) Complexity of model with respect to dynamic approach with cognitive variables. In sum, there is an incompatibility in trying to mimetic the agents as mirror to the real world. Then Sargent proposes of including: 1) Incomplete information for the exogenous variables; 2) Learning capacity / adaptation. This fact would thus shift the bounded rationality as Sargent defines to the substantive rationality according to Simon's. So, if there is a way of having a better realism within the model, then the mayhem is to "(...) finding the right course of action (substantive rationality) to finding a way of calculate what that course of action is (procedural rationality)" (Simon, 1981, p. 33-34).

In that sense, uncertainty, computational complexity and operationalisation are the main barriers to achieve the abovementioned model. In Simon's perspective: "What a person cannot do he will not do, no matter how much he wants to do it" (Simon, 1981, p. 36), and that is when he comes up with the difinition of satisficing, which are satisfactory solutions to the agent's problem, or sub-optimal solutions. This fact then makes viable the existence of institutions because a priori they are meant to minimize uncertainty and transaction costs within the society, as proposed by North (1999).

In turn, the idea of dealing with uncertainty also gives rise to the use of procedural rationality, that is, practical rationality (rationality of cognitions).

2.3 RATIONALITY AND INSTITUTIONS

Not questioning the new approach proposed by Simon, some old and new institutionalists, with special attention to Langlois (1986), argue that he gives not great attention to the in the social environment people live in, that is, how they act and interact. But at the same time, they recognize how bounded rationality is a crucial and complementary variable to the understanding of institutions, which Langlois (1986, in Dequech 2001 pg 921) deems to "serve to restrict at once the dimensions of the agent's problem situation and the extent of the cognitive demands placed upon the agents".

However, as Dequech (2001) says that it must give credit to Simon since he extensively researched organizations as part of the definition of institutions, which Williamson, for example, can be inserted on, and also analysis its importance towards the economics of transaction costs. As Dequech (2001) appointed:

"In sum, a fairly broad reading of Simon's contribution reveals important points regarding institutions. At the same time, it also reveals that there is still room for improving upon his treatment of institutions in relation to bounded rationality". (pg. 922)

What drove Dequech (2001) to say that is the fact complex social interaction and bounded rationality under uncertainty must be more studied and minimize the wedge between the institutionalism view and Simon's work. To make this link viable, Bayesian theory comes in handy, since it explores the problems of decision making process under the assumption of restraint set of states and uncertainty. In the next section some relevant axioms will be explained, connecting it to rationality.

2.4 RATIONALITY AND BAYESIANISM

2.4.1 EPISTEMOLOGICAL / STATISTICAL POINT OF VIEW

Bayes theory, as well-put by James Joyce [within the Oxford Handbook of Rationality (2004), pag. 132], recognises that "beliefs come in varying gradations of strength, (…) [seeking] to replace the categorical notion of belief as an all-or-nothing attitude of accepting a proposition as true with graded conception of belief as level of confidence". This is in line with Perelman's belief of rhetoric, where he stresses that it is the study of probable propositions, in which case it can be extracted likelihood conclusions, proclaiming a new way to rationalise.

Joyce, however, goes beyond stating the beliefs must follow the laws of subjective probability, through the probabilistic consistency for graded beliefs. Additionally, individuals have straits of conditional beliefs by supposing that others propositions are true facts.

Therefore Bayesian epistemology requires that an individual's belief must be deemed by the following requirements, as showed in Ramsey (1931) e De Finetti (1937):

(1) Logical Consequence that entails the deductive logic by an assumption leading to other, must their probability as well.

(2) Bayes's Theorem which equals the conditional probability of events to the ratio of the unconditional probabilities of those events and the inverse probability of those events or also known as likelihood.

And to consider it rational it must hold the assumptions below:

(3) Probabilistic consistency that is referred to an individual's rational subjective belief in which one of those beliefs can be represented by a probability.

Frank Ramsey, in his memorable work, Dutch Book Argument, affirmed that someone who violates the laws of probabilities are "practically irrational". In other words, an individual to be deemed rational must attain the below characteristics: - Be coherent, satisfy his beliefs, maximize his subjective expected utility.

Again coherence is quite relevant to determine the rationality of the individual (and therefore its system of beliefs). And as stressed by Joyce, those characteristics (or axioms) can be rather controversial, especially regarding to the maximization of expected utility. Although Savage (1954) defends the Utilitarism, it must be pointed out that assumptions must be coherent with one's beliefs. Those beliefs are represented by preferences and therefore the below properties must hold:

(A) Trichotomy – Good A is preferred to good B, good B is preferred to good A and indifferent if it lies in between.

(B) Transitivity – If an individual prefers A to B, B to C, then A is preferred to C.

(C) "Sure thing" Principle – If A and B result in C, then the individual's preference between A and B depends solely on their consequences when C is obtained.

(D) Wagers – Given the consequences C1 and C2 for the respective events A and B, an individual who is rational believes in A more strongly than B if and only if this individuals strictly prefers C1 [if A, or else] to C2 [if B, or else] since C1 is more desirable than C2.

It is worth stressing that probabilistic inconsistency (violation of (A)-(D)) allied to defective cognitive process is susceptible to framing effects, which can be defined as a unique option evaluated differently when presented / masqueraded under different ways. Then, inconsistencies with regards to preferences are accompanied by inconsistencies of beliefs about the value of prospects, which is a theory largely studied by economics Nobel laureate Daniel Kahneman.

Another aspect of Bayesian epistemology is with regards to the evidential support, that is, the definition of "prior" and "posterior". The first is related to the plausibility (or level of

confidence) of one's hypothesis or propositions and the second is the learning acquired by a new knowledge. Considering A and A* hypothesis, then new information (incremental evidence or else simply evidence denominated by E) is justified by three important principles in Bayesian theory:

(1) Confirmation Principle: which tells if an evidence (E) confirms hypothesis A (to some degree extent), then the conditional probability of A given the occurrence of evidence E is greater than the sole probability of A itself. Thus, E confirms (or would confirm) A. In fact this is modens ponnes, that is, affirmation of the antecedent. The reverse is also true in the sense that if hypothesis A logically entails evidence E, then E should also confirm A. This stems from the fact that to know the truth of evidence E, it is necessary to rule out the non-zero probability of complement of E (said E*) that is incompatible with the previous hypothesis A. That being said, whenever E logically entails A, E* disconfirm A by simply diminishing its probability to zero. This is actually the hypothetical – deductive method or also known as modens tollens (negation of the consequence).

(2) Surprise Principle: which says that an individual who is equally confident in A and A*, both conditional on evidence E, then E confirms A more strongly than A* does, if and only if, this individual is less confident on A being true in comparison to A*. This fact explains why unexpected evidence has more power of confirmation than evidence that is previously known by the individual.

(3) Discrimination Principle: that rests upon the fact that if there is a more evidential support to A than to A* and if A predicts evidence E as strong as A* does, then an individual will have stronger evidence on A than on A* when evidence E comes true and is added to his/her stock of knowledge.

It is worth pointing that new informations which involve the abovementioned principles actually are part of the Bayesian theory of learning, because the individual in question revises its system of belief through this new learning / information. This revision is given by two famous rules of conditioning:

(1) Simple Conditioning: - the probability of a hypothesis, given a learning process, tends to approach 1 if and only if this is confirmed by this new event. Probabilistic inconsistencies tend to shift to zero. In other words, a prior probability A conditional on the evidence E should generate a final probability – also named as posterior – conditioned on E. Simply put, these conditionality follows the Bayes' theorem, that is:

$$P(A) = P(A\,|\,E) * P(E)$$

(2) Jeffrey Conditions: - It is a weighted probability (probability of happening and its complement) given the occurrence of the learning experience. According to Jeffrey, the crucial idea behind this conditionality rests upon the fact that observations (that is, evidence E) not always results on certainty, therefore it must be counted for its negation (E*).

$$P(A) = P(A\,|\,E) * P(E) + P(A\,|\,E^*) * P(E^*)$$

As Joyce complements, those conditioning rules are designed to show that failing to condition on one's evidence can lead to practical incoherence and hence irrationality. Jeffrey, however, goes beyond in his work "Epistemology Probabilized" (2002) and says that "updating by ordinary conditioning is generalized to probability kinematics [when prior is

updated by a partition set], where an observation on a random variable X need not single out one value, but may prompt a new probability distribution over all values of X".

It worth noticing in his work the relevant fact about confronting theory with the tools of the probabilistic (Bayesian) epistemology, which uses the conditioning updating rule to analyse two (or more) theories, given a certain data. This is actually done by expanding the Bayes factor (denominated by beta below), also known as likelihood ratio: Given a data D, the Bayes factor for a theory T against another one, in this case S, is:

$$\beta(T:S) = \frac{P(D \mid T)}{P(D \mid S)}$$

But solely S and T do not falsify D and according to Jeffrey, it is necessary to use help of an auxiliary hypothesis named A, which is independent from T and S. This will yield a Bayes factor as such:

$$\beta(T:S) = \frac{P(D \mid T \wedge A)P(A) + P(D \mid T \wedge \overline{A})P(\overline{A})}{P(D \mid S \wedge A)P(A) + P(D \mid S \wedge \overline{A})P(\overline{A})}$$

Since the objective is to verify the veracity of one of the both theories, one can considered the auxiliary hypothesis to be correct (and therefore P(A)=0 and 1 otherwise), it results:

$$\beta(T:S) = \frac{P(D \mid T \wedge \overline{A})}{P(D \mid S \wedge \overline{A})}$$

Here the analysis will resume to what is the likelihood for theory T or S to fail given a false hypothesis. This fact will lead to the refutation of T or S. This sheds some light with regards to the methodology of economics in the sense that it often makes use of unrealistic hypothesis to prove a certain theory. That is going to be the main core of the following section.

2.4.2 BOUNDED RATIONALITY AND BAYESIANISM

Given the definition of bounded rationality it is clear it has epistemic grounds in the sense there is some lack of knowledge of the state of nature and therefore it is natural to think of it in terms of epistemic (subjective) probability. Therefore, the link between bounded rationality and the theory of Bayes is set. It also bridges the definition of uncertainty, which is characterized by the lack of a probability distribution due to by paucity of evidence.

Simon acknowledges (though critically) the subjective expected utility (SEU) because "people do not in reality perform all the calculations that lead to a maximization of SEU, but merely act "as if" they did". Notwithstanding that fact, SEU "postulates that choices are made: 1) among a fixed set of alternatives; 2) with subjectively known probabilities distributions of outcome for each; 3) in such way as to maximize the expected value of a given utility…Theories of bounded rationality can be generated by relaxing one or more of the above assumptions" (in Dequech 2001, pg. 917). Besides, instead of postulating the

maximization of utility, it can be proposed a satisficing alternative / strategy, as so dearly praised by Simon.

3 FURTHER METHODOLOGICAL ISSUES

The Bayesian theory enters in the economic world in a very propitious time because it embraces the conception of gradualism of beliefs. A la Rorty (or almost equivalently a la Dewey), the former gives room to the relativism in economics, strongly supported by the laws of probability. There is not a unique belief and as seen in a previous section, different evidences might suggest different confirmations of a theory in question and to confront them is necessary to apply the so called Bayes' ratio (or also known in economics as the likelihood ratio) and it might yield that a researcher may be more confident in one evidence than the other. This does not refute completely the theory, giving the possibility of tenacity as advocated by Lakatos.

As so dearly wished by Neville Keynes, Bayesianism also unifies both a piori and a posteriori methods, respecting the pluralism in the scientific method because it promotes the proliferation of theories and it does not falsify a theory dogmatically. Another interesting point is the fact that it talks to other scientific research, without imposing any dogmatic restriction (aside from the coherence regarding the laws of probability).

Another aspect from the Bayesian theory and it confronts the most dominated method in the mainstream theory in economics is the unrealism of hypothesis, praised by the Nobel Laureate Milton Friedman, in his work "Essays in Positive Economics". It is important to stress that this line taken by the neoclassical theory (or alternatively mainstream) actually violates principals posed in the former section.

Unrealism of hypothesis leads to the fact that is incoherent to the real world and therefore it results in incoherent (absent of coherence) theories. One straightforward example is the figure of "rational agent" that is omniscient to all types of knowledge and does not require any learning experience since he knows all and his next steps and hence forthcoming decisions. Rationality is limited by the cognitive process as explained in section three by the framing effects considered in the works of Daniel Kahneman.

As Herbert Simon intelligently put in his work "Rational Decision Making in Business Organization", the decision will rely on the knowledge, experience and organizational environment, to which the entrepreneur is inserted. In other words, Simon argues the difficulties faced by the entrepreneur (or more generally by an individual) are: 1) non previous knowledge about the new idea, 2) psychological barrier of the routine (habit), which succumbs the desire of doing the 'new' and finally the social barrier, because the environment positions itself against the new element. But most importantly than the 3 elements above mentioned is the great relevance that Simons places in the entrepreneurs' behaviour, being of which the capacity of limited processing (limited cognition) and the information asymmetry. All those elements according to Simon rest under the concept of "bounded rationality".

But once the new idea is created, the entrepreneur will attempt to maximize the profit, however many cognitive elements will be missing to reach the perfect maximized strategy, as known within the economics consensus. That is why he will be faced in maximizing the expected subjective utility, in order to balance out the risk taking in his decisions as previously asserted by Savage (1957).

4 CONCLUDING REMARKS

Recalling Daniel Kahneman, he stresses that: "Economic analysis is more congenial to wants and preferences than hedonic experiences, and the current meaning of utility in economics and decision research is a positivistic version of wantability: utility is a theoretical construct inferred from observed choices". This later is exactly, as previously mentioned, the scope of Bayesianism (Bayesian Theory).

So embracing Bayesian Theory in Economics will help out not only put a more probabilistic consistency within the theory itself, but also an important implication will be the attempt of drawing a more realistic hypothesis under the conditioning rules. And this setup can be deemed to be a new vision for the methodology of Economics, so well-worked in the sciences of Statistic.

As de Finetti (1937) stressed: "(…) no science will permit us say: this fact will come about, it will be thus and so because it follows from a certain law, and that law is an absolute truth. Still less will it lead us to conclude sceptically: the absolute truth does not exist, and so this fact might or might not come about, it may go like this or in totally different way, I know nothing about it. What we can say is this: I foresee that such a fact will come about, and that will happen in such and such a way, because past experience and its scientific elaboration by human thought makes this forecast seem reasonable to me"

BIBLIOGRAPHY

Allais, M., 1953, Le comportement de l'homme rationnel devant le risque: critique des postulats et axiomes de l'école Américaine, Econometrica 21, 503-546.

Bayes, Thomas, "An Essay Towards Solving a Problem in the Doctrine of Chances", Philosophical Transactions of the Royal Society of London (1764) 53: 37-418, reprinted in E.S. Pearson and M.G. Kendall, eds., Studies in the History of Statistics and probability (London: Charles Griffin, 1970).

Ben-Haim, Yakov (2006). Info-gap Decision Theory: Decisions Under Severe Uncertainty (2nd ed.). Academic Press. section 11.

Bovens, Luc, and Stephan Hartmann, Bayesian Epistemology (Oxford: Clarendon Press; 2003).

Chew Soo Hong, Jennifer Mao and Naoko Nishimura, Preference for longshot: An Experimental Study of Demand for Sweepstakes

Dequech, D.(2001) "Bounded Rationality, Institutions and Uncertainty". JEL, DEC, 35(4), pg.911.

De Finetti, Bruno, "La Prevision: ses lois logiques, se sources subjectives" (Annales de l'Institut Henri Poincare 7 (1937): 1-68. Translated into English and reprinted in Kyburg and Smokler, Studies in Subjective Probability (Huntington, NY: Krieger; 1980).

Eells, Ellery, and Branden Fitelson. 2000. "Measuring Confirmation and Evidence", Journal of Philosophy 97: 663-672.

Eells, Ellery, and Branden Fitelson. 2002. "Symmetries and Asymmetries in Evidential Support", Philosophical Studies 107: 129-142.

Ellsberg, Daniel (1961), "Risk, Ambiguity, and the Savage Axioms", Quarterly Journal of Economics 75 (4): 643–66

Ferejohn, J. & Satz, D. – Rational Choice and Social Theory – Standford University, August 1991.

Fitelson, Branden. 1999. “The Plurality of Bayesian Measures of Confirmation and the Problem of Measure Sensitivity,” Philosophy of Science 66 (Proceedings Supplement): S362-378.

Fitelson, Branden. 2003. “Review of James Joyce, The Foundations of Causal Decision Theory”, in Mind 112: 545-551.

Fox, Craig R.; Tversky, Amos (1995), "Ambiguity Aversion and Comparative Ignorance", Quarterly Journal of Economics 110 (3): 585–603, doi:10.2307/2946693

Gellner, E. O relativimo vesus verdade unica. In Antonio Cicero e Wally Salomao, orgs. 2004. O Relativismo enquanto visao de mundo.

Gigerenzer, G. & Selten, R. (2002). Bounded Rationality.Cambridge: The MIT Press; reprint edition. ISBN 0-262-57164-1

Hayek, F.A (1948) Individualism and Economic order

Jeffrey, Richard, The Logic of Decision, 2nd ed. (Chicago: University of Chicago Press; 1983).

Jeffrey, Richard, Probability and the Art of Judgment (Cambridge: Cambridge University Press; 1992).

Jeffreys, Harold, Theory of Probability, 3d ed. (Oxford: Clarendon Press; ([1948] 1961).

Jon Elster (1983). Sour Grapes: Studies in the Subversion of Rationality. Cambridge, UK: Cambridge University Press.

Joyce, James M., “A Nonpragmatic Vindication of Probabilism”, Philosophy of Science 65 (1998): 575-603.

Joyce, James M., The Foundations of Causal Decision Theory (Cambridge: Cambridge University Press; 1999).

Kahneman, Daniel (2003). Maps of bounded rationality: psychology for behavioral economics. The American Economic Review. 93(5). pp. 1449–1475

Kahneman, Daniel and Tversky, Amos. (1979) "Prospect Theory: An Analysis of Decision under Risk". Econometrica 47, 313-327

Keynes, John Maynard. (1921). A Treatise on Probability. Macmillan, London.

Khalil, E. The Bayesian fallacy: Distinguishing four kinds of beliefs. Munich Personnal Repec Archive. 2008.

Keynes, John Maynard, A Treatise on Probability (London: Macmillan; 1921).

Lakatos, I. Falsification and the methodology of scientific research programmes. 1974

North, Douglas C. – Dealing with a Non-Ergodic World: Institutional Economics, Property Rights, and the Global Environment – Conference: Duke Law School. 1999

Mele, A. & Rawling, P. The Oxford Handbook of Rationality. OUP 2004.

Quiggin, J. (1993) Generalized Expected Utility Theory:The Rank-Dependent Expected Utility model, Kluwer-Nijhoff, Amsterdam. Review

Sent, E.M. “The Evolving Rationality of Rational Expectations”. Cambridge University Press.2006.

Perelman, C. & Olbrechts – Tyteca, L. Tratado da Argumentacao: A nova retorica. Matins Fontes. 1996

Popper, Karl, The Logic of Scientific Discovery, 3rd ed. (London: Hutchinson; 1968).

Quine, W.V., “Carnap on Logical Truth”, in The Ways of Paradox (New York: Random House; 1966): 100-125.

Rorty, R. Relativimo: o encontrar e o fabricar. In Antonio Cicero e Wally Salomao, orgs. 2004. O Relativismo enquanto visao de mundo.

Ramsey, Frank P., "Truth and Probability," in Richard B. Braithwaite (ed.), Foundations of Mathematics and Other Logical Essay (London: Routledge and Kegan Paul; Check on 1931 publication date), pp. 156-198.

Rubinstein, A. (1998). Modeling bounded rationality, MIT Press.

Sargent, T.(1993) Bounded Rationality in macroeconomics, New York, Oxford University Press.

Savage, Leonard, The Foundations of Statistics, 2nd ed. (New York: Dover; 1972).

Schumpeter, J.A. – Teoria do Desenvolvimento Econômico - São Paulo, 1985: Nova Cultural.

Simon, Herbert (1957). "A Behavioral Model of Rational Choice", in Models of Man, Social and Rational: Mathematical Essays on Rational Human Behavior in a Social Setting. New York: Wiley.

Simon, Herbert (1990). A mechanism for social selection and successful altruism, Science 250 (4988): 1665-1668.

Simon, Herbert (1991). Bounded Rationality and Organizational Learning, Organization Science 2(1): 125-134.

Simon, H. – Rational Decision Making in Business Organization – American Economic Review, 1979, V69.

Tisdell, Clem (1996). Bounded Rationality and Economic Evolution: A Contribution to Decision Making, Economics, and Management. Cheltenham, UK; Brookfield, Vt.: Edward Elgar.

Vercelli, A. (1992) Por uma Macroeconomia não Reducionista: Uma Perspectiva de Longo Prazo, Economia e Sociedade, n. 1, ago.

Williamson, Oliver (1981). The economies of organization: the transaction cost approach. American Journal of Sociology 87 (3): 548-577.