A General Theory of Welfare:
Moral goods and Right Conducts under Uncertainty

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Abstract

This essay aims to find a reply to the following question. From the point of view of rationality, what characteristics must a general theory of welfare (GTW) have? Welfare economics is made up of a certain number of theoretical models that we distinguish according to the conception of moral value on which they are based, and the right conduct they suggest. As regards moral values, two fundamental conceptions of moral good exist: the ethics of motive makes reference to subjective values; while the ethics of end also admits objective values. As regards right conduct, Bayesian reductionism and rational dualism are two different ways of considering uncertainty about economic phenomena. Bayesian reductionism assumes that agents have all the information and computing capabilities for applying the maximisation procedure; in particular they are always able to establish numerical subjective probabilities. Rational dualism also admits situations where agents have cognitive limitation for maximising welfare, and procedures other than maximisation are admitted, in particular probabilities may be non-measurable and non-comparable. Since a rational choice between different moral systems and probability conceptions cannot be made, this awareness leads us to think in terms of a GTW. From the point of view of moral values, a GTW must admit all the possible values in which a society can believe; while from the point of view of instrumental rationality, it must also admit situations where decision-makers do not have adequate information and behave in conditions of non-measurable uncertainty.

Key-words: welfare theory, moral good, right conduct, ethics of motive, ethics of end, substantive rationality, bounded rationality, risk and uncertainty

JEL classification: A12, D60, D63, D64, D81, D83, E12

1. Introduction

The postulate of rationality is the methodological foundation of economics. It celebrates human rationality in all the ways that it reveals itself (Simon, 1985, p.369). Since the choice of ends or moral values may also be connected to the problems of their pursuit, rationality has two main aspects: the aspect of the choice of ends, and the aspect of right conduct.

Welfare economics consists of a certain number of theoretical models that may be distinguished according to the conception of moral value on which they are grounded, and the right conduct they suggest. Two fundamental conceptions of moral value are distinguished, which justify the existence of different models of welfare economics: the *ethics of motive* and the *ethics of end*. The ethics of motive makes reference to subjective values; while the ethics of end recognises intrinsic objective values (Marzetti, 2001). As regards right conduct (instrumental rationality), two conceptions of rationality are also distinguished: Bayesian reductionism and rational dualism. These are two different ways of considering uncertainty about economic phenomena. Bayesian reductionism assumes that agents are always able to maximise welfare and to establish at least numerical subjective probabilities. Rational dualism, instead, distinguishes situations simple enough to be fully understandable by human mind, where decision-makers are capable of applying the procedure of welfare maximization (substantive rationality), from situations too complex to be fully understandable where the maximisation procedure cannot be applied (procedural rationality), as in the case of non-measurable uncertainty because probabilities cannot be established.

Given the existence of these different moral systems and probability conceptions, the aim of this article is to give an answer to the following question: from the point of view of rationality, which characteristics must a general theory of welfare (GTW) have when conditions of non- measurable uncertainty are also admitted? Therefore, in sections 2 and 3 an analysis is given of the main economic welfare models based on the ethics of motive and the corresponding instrumental rationality. Section 4 examines the ethics of end and considers in particular Moore's doctrine about the ideal in order to better understand his influence on John Maynard Keynes's moral and economic thought. Section 5 considers criticisms of utility maximisation and justifies procedural rationality in particular in conditions of non-measurable uncertainty. We highlight that sections 2-5 deal with these welfare theories outside their historical setting, since we are interested in the moral values on which they are based and the means suggested to pursue them. Section 6 outlines the fundamental characteristics of a general theory of welfare (GTW). Finally, the concluding section highlights that a GTW has to allow all the possible values in which a society can believe; while from the point of view of instrumental rationality, it must admit not only situations where decision-makers have all the information and computing capabilities, but also situations where they do not have adequate information and capabilities, and behave under conditions of non-measurable uncertainty.

2. Welfare theories based on the ethics of motive

The ethics of motive aims to determine the motives – the reasons – of human conduct in order to discipline the conduct itself. It is an ancient conception which dates back to Aristippus and

Epicurus. Good is intended in the subjective sense, and it is perfection because it is desired. Two cases are distinguished: i) a thing is useful when it is desired as means or is a means to attain pleasure; ii) a thing is liked or desired for itself, it is good in itself (subjective intrinsic value). Since the reference is always to *subjective* pleasure or preference, amongst alternative goods, establishing which is the most rational is meaningless, unless they are intermediate ends for reaching a superior good. If we consider pleasure or preference the motive which leads human beings to act, moral good is an object of desire (a natural object), and ethics is the discipline of conduct which guides human choices to the end of pleasure or in order to satisfy preferences (a good action is that which provides pleasure or satisfies preferences). Lorenzo Valla, Baruch Spinoza, John Locke, Gottfried Leibniz, David Hume, Cesare Beccaria, Jeremy Bentham, Immanuel Kant and Bertrand Russell believe in this ethical doctrine.

Hedonism (Egoism and Utilitarianism), the neo-Humean view and the Kantian moral view are ethics of motive which are the ethical foundation of different economic welfare models. The classical theory of social utility is based on cardinal utility and interpersonal comparisons, and is 'the accidental deposit of the historical association between English Economics and Utilitarianism'(Robbins, 1984, p.141). The New Welfare Economics (NWE) and the Theory of Social Choice (TSC) are based on the neo-Humean view. Models also inspired by Kantian Ethics are Rule Utilitarianism (RU) and the optimal growth theory based on moral obligations for pursuing intergenerational justice.

2.1 *Traditional Utilitarianism: Benthamism*

According to Hedonism, pleasure is the only *summum bonum* - the fundamental *motive* of human conduct. It is the foundation of human life and legislation; while things such as justice, nature, freedom, and truth are only means to reach the greatest pleasure (Bentham, 1948, p.125).

Hedonism intended as 'utilitarianism' claims that the general pleasure is good for a community. In particular, utilitarianism in Bentham's version (1948, pp.126-7) claims that the interest of the community is 'the sum of the interests of the several members who compose it.' Methodological individualism (society is a collection of independent parts) and an aggregative conception of interpersonal impartiality (the moral importance is attributed to pleasure alone, and not to whoever has pleasure) justify the belief that society is a stable structure, governed by material laws and not by psychological laws.

Since the sole rational object of conduct is the greatest pleasure of the greatest number, morality aims to maximize utility, intended as the exact balance between pleasure and pain with respect to the total number of individuals. Interpersonal comparisons are admitted without any discussion, and

each agent is assigned the same weight. The value of the consequences of any action is exactly measurable, therefore, not only are pleasures and pains numerically measurable and arithmetically additive[2], but probabilities too are numerically measurable and comparable.

Society is seen as a collection of homogeneous agents who regularly behave in a social environment in which *laissez-faire* is admitted. Each equally egoist agent is equally able and free to behave according to reason, i.e. to compare pleasures and pains. This gives a scientific foundation to the belief that private interest and social good are in harmony. Therefore, as Keynes (CW IX, p.275) claims, 'the political philosopher could retire in favour of the business man – for the latter could attain the philosopher's *summum bonum* by just pursuing his own private profit'. This view considers economics as a moral science, where the main task of policy-makers is to promote social utility through punishments and rewards.

2.2 *The neo-Humean view*

In the Humean view no single *summum bonum* emerges. According to Hume (reprint 1910), the fact of considering that a thing is good means that people prefer it. Feeling and reason are equally involved in morals: feeling, intended as preference, is the fundamental motive of conduct; while reason is an instrument in the service of our preference.

The welfare theories based on the Humean moral view are based on the assumption of *impartiality to the ends*: morality requires every one of us to be impartial to the ends of one person over another. Welfare is identified with preferences, but preferences are not specifically identified with pleasure or happiness. Simply, a good is useful if it is preferred, and a utility function is considered a very convenient way to describe decision-makers' preferences.

2.2.1 Ordinal utility: NWE and TSC

NWE does not admit interpersonal comparisons of utility. A welfare function is intended as a function which produces an ordering of social preferences (Bergson, 1938; Kaldor, 1939; Hicks, 1939). Pareto (1895) optimality is admitted as criterion of aggregating individual preferences. Its success depends on the fact that its moral content is less controversial than that of utilitarianism: the first value judgement is the individualistic foundation that each agent is considered the sole judge of his/her own welfare; the second value judgement is that changes, 'which benefit some people without damaging others, … represent an increase in economic welfare' (Hicks, 1939, pp. 700-701). A non-optimal Pareto situation becomes optimal if the distributional constraint that a sacrifice (measured in terms of utility) requires a compensation (SRC) is, at least potentially, satisfied (Brink, 1993, pp. 252-8). Therefore, uncompensated sacrifices are morally unacceptable.

Nevertheless, the compensation principle can be referred to people of the same generation, but when present and future generations are considered, such as in sustainable development situations, not only does it raise the issue of compensating future generations, if actions of the present generation impose losses on the future generations, but it also raises the philosophical issue of compensating the losses of the present generation when their behaviour favours future generations. This issue is still open, since future generations may not exist: they are only 'possible' individuals. Therefore, when a policy-maker (who represents the present generation) applies the take-care-of-tomorrow policy, it satisfies the value of intergenerational justice but this policy is incompatible with the Pareto criterion of efficiency, because in this case nobody can compensate the present generation (Parfit, 1982; Temkin, 1993).

The Pareto criterion is also admitted by the TSC according to which a procedure of vote is a way of aggregating individual preferences. Nevertheless, the main theoretical result of this theory is the Arrow impossibility theorem (Arrow, 1951), which claims that, given a minimum number of desirable value judgements or conditions (unrestricted domain, non-dictatorship, Pareto efficiency, non-dependence on irrelevant alternatives), there is no social welfare function which produces a transitive order of preferences and satisfies those conditions. More recent research on decision-making theory under uncertainty, based on a rational and pure qualitative model which does not assume commensurability, provides efficient results only in very specific situations, and further research is suggested in order to overcome the difficulties highlighted by Arrows' theorem (see in particular Dubois D. *et al*., 2003).

2.3 *Growth models based on altruism: intergenerational justice*

In traditional ethics "the ethical universe is composed of contemporaries… ' (Jonas, 1974, pp. 7-10), and in the dominant scientific view nature has no ends; only human beings are the source of all value in nature (anthropocentric view). Utilitarianism, in fact, does not consider distributive justice, and in particular intergenerational justice, as moral phenomenon, therefore it could suggest following an action which impoverishes future generations, if it maximises the social utility of the present generation; while, as regards the neo-Humean view, pursuing intergenerational justice means not satisfying Pareto efficiency. Therefore, the philosophical issue of pursuing intergenerational justice is left open by these doctrines.

Securing the welfare of future generations by taking into account the future exploitation of natural resources became a fundamental aim of growth theory after the publication of *The Limits of Growth* by Meadows et al. (1972) and *Technology and Responsibility* by Jonas (1974). In particular, since the modern technological revolution has changed the nature of human action, Jonas (ibid, pp.

7-10) justifies and develops the idea that humanity needs a new ethics, and highlights that 'nature as a human responsibility[3] is surely a *novum* to be pondered in ethical theory'. In this section we deal with growth models based on selfish altruism (enlightened self-interest) identified with the assumption that each generation exhibits altruism for its descendants; while in section 2.4.2 we deal with growth models based on *moral obligations*, which are justified by the belief that selfish altruism may be inadequate to secure intergenerational justice (Asheim, 1996, pp. 55-57).

Optimal growth theory based on subjective altruistic preferences admits that a subjective altruist generation is willing to contribute to the welfare of future generations because the former's total welfare not only depends on their own utility but also on the utility of other generations. Therefore, in this intergenerational context, growth theory admits that: i) the social welfare of one generation is represented with a function of individual utilities; ii) a welfare loss to one generation can be more than counterbalanced by a welfare increase in another; and, iii) the social welfare function is usually represented as the sum of the utilities of generations (Solow, 1974).

2.4 *Subjectivist welfare theories inspired by Kantian ethics*

Kantian ethics admits that what is pleasant has to be also considered pleasant by reason in order to be considered 'good', and that ethical action is an action according to a rule which has to be universal (Vigna, 2001). Therefore, the following welfare theories inspired by this ethics admit that in pursuing social welfare some universal moral rule has to be respected.

2.4.1 Cardinal Preferences: RU

According to Harsanyi (1976), the ultimate moral value is the welfare of individual members of a society, and utility is identified with preferences which are cardinally measurable and comparable. Because preferences are assumed to be cardinally measurable, they are named *cardinal preferences*, which are of two kinds. Each agent expresses his/her own preferences not only in his/her personal or individual utility function (*actual* preferences), but also in his/her personal social welfare function (*moral* or *ethical* preferences). Individual preferences are defined in terms of personal and partial criteria; while moral preferences are identified as the hypothetical preferences that each agent 'would entertain if he forced himself to judge the world … from an impersonal and impartial point of view' (ibid, p. IX). This hypothesis of *impersonality* and *impartiality* satisfies the need to introduce in the model some form of objectivity, and is based on the following moral code: 'Treat other people in the same way as you want to be treated yourself' (Harsanyi, 1958, pp. 311-313), which has the social function 'to enjoin people to do certain things and not to do some other things' (Harsanyi, 1958, pp. 311-313). For example, it can satisfy the demand of justice (Harsanyi, 1976, p.

74) and not to require the respect of the SRC principle. As regards the admission of interpersonal comparisons of utilities, the justification is that 'the ultimate logical basis for interpersonal utility comparisons lies in the postulate that the *preferences and utility functions of all human individuals are governed by the same basic psychological laws*' (ibid, p. 50).

Nevertheless, as regards practical applicability, Harsanyi (1986, p. 60) himself highlights that 'rule utilitarianism … is not a criterion always easy to apply in practice', since in the real world an agent is unlikely to choose a particular action in complete ignorance of his/her personal position.

2.4.2 Optimal growth theory based on moral obligations

Inspired by Kantian ethics, growth models which pursue intergenerational justice and aim to make sustainable rational choices distinguish altruism (see section 2.3) from moral duties (Howarth, 1995, pp. 417-421). Different kinds of moral duty about intergenerational justice exist, and they are evaluated for their consequences. We highlight two main kinds of models: i) the Hartwick-Solow rule, and ii) the ethical social choice theory.

i) Solow (1974) applies Rawls' max-min criterion[4] to the intergenerational problem of optimal capital accumulation, highlighting that the standard macroeconomic theory of optimal capital accumulation sidesteps the intragenerational problem by assuming that all members of any given generation are identical. The max-min criterion states that the welfare function should be sensitive *only* to gains and losses of utility by the poorest (ibid, p. 29). In particular, as regards justice between generations, Rawls (ibid, par. 44) claims that the maximum level of expectations of those with least advantages is connected with the sharing of the burden of capital accumulation between generations.

A result of the application to the intergenerational context of this criterion together with the presumptions that natural and man-made capitals are substitutes, and that population is constant over time, is the well-known Hartwick-Solow rule: 'the investment of current exhaustible resource returns in producible capital implies per capita consumption constant' (Hartwick, 1977, p. 974). This altruist saving, intended as renouncing present consumption in order to maintain a constant consumption path, is seen as a minimum personal sacrifice for leaving assets to future generations. This model is subject to much criticism. In particular, Solow (1974, pp. 34-41) himself highlights that the least satisfactory aspect of the max-min principle is that, if the initial capital stock is not high enough for a decent standard of living, poverty is perpetuated, since capital could be accumulated and consumption increased 'only at the cost of a lower standard of living for earlier generations. But … there is no way the past can be compensated by the future after the saving has taken place and the productivity of capital goods exploited'.

ii) Inspired by Harsanyi, the ethical social choice theory imposes *ethical preferences* 'vs' subjective preferences in an intergenerational context, where a moral duty is seen as a constraint to the pursuit of self-interest of the present generation or of the future generations (Asheim, 1996; Marzetti, 2007). Models based on an ethical social choice combine subjective utility with the moral duty of excluding socially unacceptable utility paths. In particular, in Asheim *et al*. (2001) a morally acceptable utility path has to satisfy Pareto efficiency and equity; while it is obtained in Howarth (1995) by imposing on the subjective welfare of each generation the 'prior constraint' of maintaining the future generations' welfare at least equal to the present generation's welfare, and in Chichilnisky (1996, p. 237) by admitting the moral obligation that 'neither the "present" nor the "future" should be favoured over the other'.

A general criticism of the theory of growth models based on moral duties is made by Pezzey (1997, p. 460), who highlights that the choice between the different moral duties is 'personal, rather than scientific or democratic'.

3. **Instrumental rationality and ethics of motive**

What kind of instrumental rationality is associated with economic welfare theories based on the ethics of motives? Rationality here is an instrument which coordinates the means with the ends; therefore means are good for its consequences. According to welfare theories based on the ethics of motive considered here, the rational criterion of choice is the maximization of utility (MU), mainly applied as maximization of expected utility (MEU).

3.1 *Substantive rationality*

Since the consequences have to be predicted, there is a close relation between decision and forecast. When it is assumed that there are no cognitive limitations, agents behave in condition of full or substantive rationality. The best action which maximises expected utility is conditioned by the complete knowledge of all its possible consequences, of the degrees of value ascribed to that action and also to all its consequences; in addition, all the possible alternative actions, their consequences and their values have to be known. It would seem that in order to know the best action at a given instant, agents should know all the future history of the world. In these conditions their problem is purely logical, and they behave as if the expected value is the certain value of utility since the mathematical probabilities (or frequencies, or objective probabilities) are known. The problem of choice has been transformed into an equivalent certainty problem, because the calculus of probability is 'supposed to be capable of reducing uncertainty to the same calculable status as that of certainty itself' (Keynes, CW XIV, pp.112-113).

Individual and strategic rationality are distinguished. The rational expectations hypothesis (REH) well describes individual substantive rationality. It assumes that: i) agents maximise their utility functions subject to some constraints, and ii) the constraints are perceived by all the agents in a mutually consistent way (the mutual consistency of beliefs). Decision-makers are able to represent their beliefs as probability distributions, and their subjective probability distribution coincides with the objective probability distribution (Muth, 1961)[5]. This definition of rationality is stricter than that admitted by Bayesian rationality, which does not require subjective probabilities to be equal to objective probabilities.

When we move from individual rationality to strategic rationality, agents' interactions are modelled through game theory. They have to consider that the economic environment is composed of other agents, that they are part of their environment, and that they are aware of this, and so on. This means that they must also be able to foresee all the possible actions by others according to a probability distribution. Von Neumann and Morgenstern (1947) assumed that in a condition of risk, each agent knows the objective probability distribution which governs the random process.[6]

3.2 *Bounded rationality and MEU*

Models of bounded rationality are justified by the awareness that in practice agents have cognitive limitations. Since it is quite difficult to recognise that in the future what is now non-conceivable will instead be conceivable, the MEU procedure is applied in the awareness that it is more realistic to assume that subjective (inductive) probabilities - which may change from individual to individual - are different from objective probabilities, and that the objective probability of each possible event is unknown to the rational agent (Sargent, 1993). Subjective probability - based on Bayesian probability theory which interprets the probability of an event not as frequency but as a measure of a state of knowledge - is assumed to be either numerically measurable, or it does not exist (Ramsey, 1931; DeFinetti, 1938; Savage, 1954).

In particular, in a strategic context, a Bayesian decision-maker ascribes a subjective probability to each of the possible strategies by other agents according to the best available information, and has good reasons to believe that the other agents also behave in the same way. Harsanyi too admits Bayesian rationality postulates, and in his RU model states that a moral action is chosen in two steps. Firstly, all agents choose the *moral rule* or code which maximizes the expected social utility out of the set of all possible moral rules; in this step the ultimate criterion of morality is the consequentialist criterion of social welfare maximization. Secondly, each agent chooses a personal act consistent with the socially optimal code, and it is admitted that a code may evaluate individual

acts by a non-consequentialist criterion, 'if such a moral code is judged to yield higher social utility' (Harsanyi, 1986, p.59).

If we admit that agents can learn about probabilities, adapting models in a dynamic context deal with the formation of expectations when imperfectly informed agents are confronted with situations about which they do not know the objective probabilities. They revise 'expectations in the light of past observed expectations errors' (Pesaran (1987, p.19). Agents' actions generate new information, and they adapt and learn; they can also learn from the experience of other agents (Day, 1975). The basic idea is that, through a learning process, agents may correct subjective probabilities until they are equal to objective probabilities. In order to face the uncertainty which characterizes the economic situation considered, they try to behave like econometricians, whose task is to transform the sample information and the conceptual probability model associated with it 'into more specific knowledge about the unknown model components and parameters' (Mittelhammer *et al*., 2000, p.6).

A last question remains to be answered: How do we have to behave when it is also difficult to establish subjective probabilities? Harsanyi's (1997, p.111) answer is that in practical decisions, if we do not know the objective probabilities, if we do not even have sufficient information for establishing the subjective probabilities, and if we have no reason for preferring one alternative to another, then it is reasonable to act as if their probabilities are equal. This means resorting to the Bernoullian principle of indifference (Keynes, 1921, ch. 4).

3.3. *Environmental uncertainty as risk*: *MEU vs discounted utilitarianism*

Environmental uncertainty deserves special attention. As regards natural environment, uncertainty has to be also considered about future generations' needs, tastes and values, the future availability of natural resources (non-anthropogenic environmental changes), future growth population and technology.

In this dynamic context a standard model is *discounted utilitarianism*, where utilities are cardinally measured, and the discount rate is the guide for intertemporal decision. Uncertainty is considered by raising the discount rate by an amount which reflects the lack of information about environmental management. Nevertheless, this practice is considered to be unsatisfactory by some authors (Chichilnisky, 1997; Asheim and Buchholz, 2003). In particular, Chichilnisky (1997, p. 489) claims that a discounted utility function represents a dictatorship of the present over the future generations because more weight is attached to the near generations' utility. Therefore, in some models discounted values are substituted with expected (discounted or not) values.

Dasgupta and Heal (1974, pp. 18-27), for example, also create a model which deals with uncertainty about technological innovation through which an essential natural resource is made inessential (perfect substitutability). The nature of the technological change is known, but the date of the technological change is assumed to be unknown and random with a given probability density function. Therefore, a valuation function of the expected discounted utility is built and maximized over some specific constraints. Howarth (1995, pp. 422-3), instead, considering intergenerational altruism, suggests a model where a social decision maximises the expected utility under the constraint of the evolution of the state of nature, which depends on a stochastic variable capturing the decision makers' 'subjective uncertainty regarding the consequences of social action' on the state of nature.

From the operational point of view, nevertheless, these stochastic models encounter the difficulty of establishing probabilities in many cases. Fucheaux and Froger (1995) highlight that the complexity and irreversibility of 'human-social-ecological histories' are characterised by great indeterminacy about future consequences of present actions and also their probability of occurrence. In addition, Howarth (1995, p. 423) claims that in dynamic stochastic programs where there are no concrete data, 'competing sets of plausible yet arbitrary assumptions can generate widely divergent policy conclusions.' This means that, as regards environmental management, there are situations where uncertainty cannot even be identified with risk, because objective probabilities cannot be computed, and when subjective probabilities are different from individual to individual there is no scientific basis for choosing between competing probabilities (Marzetti, 1999). In these situations the existence of non-measurable uncertainty makes environmental economists aware of the need for adopting other criteria of rationality, such as heuristic rules of thumb that prevent undesired outcomes. We will deal with this aspect of rationality in section 5.

4 **Welfare theory and ethics of end: from Moore to Keynes**

The simplification of excluding objective values is questionable. If we make reference to the moral values involved in sustainability, for example, non-anthropocentric ethics claims that, through reason, an intrinsic objective value - the primary value (PV) - also has to be recognised to the natural system, considered as a whole. The primary value is independent of the individual's preferences, because a functioning ecosystem is essential to human lives and 'its services cannot be traded for other goods; … the substitution of ecosystem services is beyond human capacity' (Weikard, 2002, p.21). Therefore, according to this view, the pursuit of a sustainable development today requires a moral evolution which is well described by Jonas (1974, p. 10): 'It would mean to seek not only human good but also the good of things extra-human, that is, to extend the recognition

of “ends in themselves” beyond the sphere of man’.

In general, according to the *ethics of end*, reason also has to establish if an end is desirable in itself. This is an ancient conception referred to Plato and Aristotle. Plato believed that happiness cannot be identified with pleasure, and that it was connected to virtue; while Aristotle highlighted the contemplative characteristic of happiness (Birks, 1874, p.213). Good is a perfect reality, which is deduced from the rational nature of human beings. Therefore objective values are justified by the attempt to remove doubts, criticism and negation from specific values. Rationality is intended in the universal sense, because reason is able not only to coordinate means to the end, but also to understand the ultimate ends of humanity. The Stoics, St. Thomas Aquinas, Antonio Rosmini, Georg Wilhelm Friedrich Hegel, Johann Gottlieb Fichte, Thomas Hill Green, the Cambridge neo-Platonists, George Edward Moore and Benedetto Croce are leading scholars within this tradition.

We focus here on Moore’s doctrine of the ideal, since it is on this that Keynes’ conception of moral value and economic welfare is based. Compared with the Humean and Kantian views, it also recognises objective intrinsic values. Compared with Hedonism, it also admits a plurality of moral values.

4.1 *The ideal as state of mind*

Moore’s ethical conception is an important criticism of all the theories which belong to ethical naturalism or psychologism such as Hedonism, Humean view and Kantian ethics, of which modern ethics has taken profit. Moore describes, as an example, two different kinds of philosopher: the hedonist who claims that ‘good is pleasure’, and the philosopher who states that ‘good is what is desired’. ‘Each of these will argue eagerly to prove that the other is wrong’ (Moore, reprint 1959, pp.10-11 - first ed. 1903). Nevertheless, their position is merely a psychological one, since ‘desire is something which occurs in our minds, and pleasure is something else which so occurs’ (ibid). Therefore, as regards the nature of good, Moore states that ‘our knowledge cannot be confined to the things which we can touch and see and feel’ (ibid, p.110). Indeed, when we say that a thing is good in itself, its goodness is an object of thought, a state of mind.

The identification of what is good is a complex issue, and Moore admits that the ends of human conduct derive from the rational and metaphysical nature of human beings, because not always do we approve what we like, and there is no doubt that common sense believes that many states of mind, less pleasant, are better than many others more pleasant. He defines the ideal as what is good in itself in high degree. Life, nature, justice, virtue, knowledge, truth, personal affections, and beauty may be good as ends in themselves.

The ideal (supreme good) has the characteristics of a complex organic whole, and '*the value of such a whole bears no regular proportion to the sum of the values of its parts*' (ibid, p. 27). Therefore, it is a mistake of the doctrines based on methodological individualism to believe that, if a certain number of things form a whole, the value of that whole is the sum of the value of things that compose it. To the question 'How can good be defined?', his reply is that it cannot be defined and analysed since it is a 'quality which we assert to belong to a thing'**.** Since nothing can prove the proposition which claims that the goodness of a thing is true, each decision about what is good depends on direct intuition in each specific case.

Nevertheless, even if Moore provides the principles of ethical reasoning and some conclusions about what is good, his ethics is not a complete system. Though he highlights that there is a contradiction in terms in the transition from egoism to utilitarianism that cannot be solved by assuming that the same conduct produces both these things, he does not provide a solution to the issue that private good and public good may not coincide (Skidelsky, 1983). In addition, he does not specifically admit some logical nexus between economic welfare and ethical good. Therefore, since a welfare theory requires a solution to these two problems, we focus on Keynes's thinking about social welfare, which tries to reconcile private interest and social good, and to justify the passage from material welfare to ethical goodness.

4.2 *Keynes' moral philosophy and theory of rational decisions*

Keynes adheres to Moore's idealism which admits that ends too can be rationally established. His philosophical beliefs are expressed in his early philosophical writings (Keynes, 1904-1906) and other writings such as *The End of Laissez-faire* (CW IX), *My early Beliefs* (CW X), *The General Theory of Employment* (CW XVI), *Art and the State* (CW XXVIII), and *Economic Possibilities for our Grandchildren* (CW IX); while his theory of rational decisions (presented in section 5) is stated in *A Treatise of Probability* (CW VIII) where, as regards the consequences of a rational act, he also admits procedures different from that of MEU.

4.2.1 Keynes' view of moral value: the principle of organicism

Keynes considers economic science a moral science, and identifies moral goods with Moore's ideals. As regards the application of the organic principle to moral goodness it seems that there has been an evolution in Keynes' thought. In his early writing *Miscellanea Ethica* (Keynes, 1905, unpublished, pp. 21-23) Keynes claims not only that utility belongs to the class of organic units, and that this 'leads to difficulties in the pure economic theory', but also that 'in ethical calculation each individual's momentary state of mind is our sole unit. … But beyond each individual the organic

principle cannot reach.' Nevertheless, later in his *A Treatise of Probability* and *My Early Beliefs* Keynes admitted other forms of organicism (CWVIII, pp. 343 and 353-4). At the beginning of the twentieth century, in fact, philosophical thought was leaving the atomistic vision for the organic vision of things, and this unavoidably influenced the evolution of all social sciences (see Gruchy, 1947-8, pp. 237-8; Marzetti, 2007).

From the awareness that the structure of ethical action is organic, it follows that the structure of social and economic action also has an organic component. The importance of this conviction is even highlighted by Karl Popper (1957, p. 30), who claims that a social group is something more than the simple total sum of its members, and is also something more than the simple sum total of the purely personal relations existing between the single members at some given time.

4.2.2 The sacrifice of individual good for the pursuit of the social good

Having established what moral good is, and having recognised its organic nature, Keynes (1906, pp. 4-12) gives a reply to the following question: If the duty to behave well is in conflict with the fact of being happy, 'ought I to sacrifice myself, my own goodness on the altar of humanity?' From the point of view of logic, nothing can prevent individual good and social good from competing: the duty of an agent as individual is to acquire good states of mind for her/himself, while as citizen the duty is to help society to reach a good situation even if to her/his own detriment. In the awareness that both personal good and universal good have claims that are difficult to reduce to common terms, Keynes acknowledged that a personal sacrifice may be moralised by pursuing a social good.

According to the situation, the objective nature of the ideal justifies the sacrifice of the private interest without any compensation for the pursuit of the social good (Keynes, CWIX, p. 295; CWXXI, p. 375). This view not only denies the utilitarian harmony between private good and social good and the fact that no kind of loss is intrinsically more important than another, but it also conflicts with the Paretian criterion which is valid only if, because of a change, nobody suffers a loss. It is, instead, shared by Harsanyi who admits that an individual can sacrifice his personal good in order to respect the moral rule that yields higher social utility.

By distinguishing between private good and collective good, Keynes also distinguishes between private action and public action. Society establishes the universal moral values and also the link between ethics - which aims to determine what individuals ought to do – and politics – intended as art and science of government whose main aim is the organization of material welfare in order to attain the results of a good life. According to Keynes (ibid), Edmund Burke provides a political philosophy logically coherent for justifying the intervention of the policy-maker as means to promote the maximum good of the society (Keynes, CWIX, p. 294; 1904b, p.81). In short, Keynes

combined Moore's conception of moral good with Burke's practical ethics: the first conception states that ultimate ideals exist in heaven, while the second states that those ideals can be satisfied on earth through reason (Fitzgibbons, 1988, p. 62).

4.2.3 Ethical goodness and economic welfare

The fact that a policy-maker ought to promote the public good by pursuing right purposes through suitable methods raises the issue of the relation between economic welfare and ethical goodness intended as good states of mind. In Keynes' system of thought, there is not an immediate and precise logical nexus between economic welfare and ethical good, because the passage from material welfare to supreme good is an *art* that someone may not possess. Therefore, economic welfare is only one requirement of ethical goodness; it is an *intermediate good,* which in turn is a means for pursuing the supreme good (Marzetti, 1999). In particular, in *Economic Possibilities of our Grandchildren* (CWIX, pp. 326-8) Keynes claims 'that the economic problem is not – if we look into the future – *the permanent problem of the human race*. … But it will be those peoples, who can keep alive, cultivate into a fuller perfection, the art of life itself and do not sell themselves for the means of life, who will be able to enjoy the abundance when it comes.'

In a context where the economic agent may not attain the philosopher's *summum bonum* by maximising her/his utility because private good may compete with social good, and the logical nexus between ethical good and economic welfare may not be immediate and precise, Keynes - aiming towards the maximum ethical good - does not focus on maximum economic welfare but on national income. More specifically, he considers *intermediate objectives* - such as a just distribution of income and wealth, full employment and monetary stability - whose achievement is seen as the right solution of the main issues about the economic organisation of society. Thus, the task of ethical rationality is to establish in which way and to which degree the possibilities of economic welfare are used.

Therefore, Keynes (CWVII, p. 379) leaves to classical theory the task of describing the behaviour of single agents (consumer/producer), and he assigns to his macroeconomic theory the task of justifying policy-maker's actions. If policy-makers have to guide the economic system in order to promote the social welfare, they have to know the laws that govern the behaviour of the economic system as a whole. These laws are not completely atomistic laws, but laws with an organic component. To our mind, Keynes' sacrifice of the welfare function is the *Keynesian simplification about welfare*; it is designed to avoid all the difficulties which can arise when a theory makes reference to the concept of utility or preference and to the duty of calculating exactly the consequences of a moral action (Marzetti, 2007).

5. Instrumental Rationality and Ethics of end

Though Moore (1959) criticises utilitarianism about what good is, he recommends a right conduct very similar to that recommended by utilitarianism[7]. Nevertheless, he specifies that rational decision-makers meet difficulties in choosing the best action. The issue is about practical ethics, intended as the pursuit of the moral good according to a reasonable or probable expectation of obtaining it, given agent's knowledge. He claims that 'it is obvious that our causal knowledge alone is far too incomplete for us to assure ourselves of this result. Accordingly it follows that … we can never be sure that any action will produce the greatest value possible. … The utmost, then, that Practical Ethics can hope to discover is which, among a few alternatives possible under certain circumstances, will, on the whole, produce the best result. … But it is plain that even this is a task of immense difficulty. … The first difficulty in the way of establishing a probability that one course of action will give a better total result than another, lies in the fact that we have to take account of the effects of both throughout an infinite future. … It is quite certain that our causal knowledge is utterly insufficient to tell us what different effects will probably result from two different actions, except within a comparatively short space of time' (ibid, pp.149-54).

5.1 *Keynes' criticism of MEU*

Keynes did not share ideal utilitarianism, but he seems influenced by Moore's awareness that in practical application ethics meets some difficulties in giving duties which produce the greatest sum of good. Mathematical expectation, intended as the product of a judgement of goodness and a judgement of probability, is based on two assumptions that Keynes (CWVIII, pp. 343-4) finds unjustified: 'first, that degrees of goodness are numerically measurable and arithmetically additive, and second, that degrees of probability are also numerically measurable'.

Organicism justifies this belief, since the position of each element of the economic system, being (in some sense) dependent on that of the others, determines the non-measurable or irreducible uncertainty of economic phenomena. In fact, 'the atomic hypothesis which has worked so splendidly in physics breaks down in psychics. We are faced ... with the problems of organic unity, of discreteness, of discontinuity – the whole is not equal to the sum of the parts, comparisons of quantity fail us, small changes produce large effects, the assumptions of a uniform and homogeneous continuum are not satisfied' (Keynes, CW X, p. 262).

More specifically, as regards moral good, when organic relations are admitted, it has to be also admitted that quantities of goodness are not always subject to the laws of arithmetic, as highlighted in section 4. As regards the measurability of probability, instead, the lack of a scientific basis for

computing probabilities would depend on the existence of continuous social interactions which can determine significant changes in the economic structure from the quantitative and qualitative point of view.

Therefore, mathematical expectations of alternative courses of actions are not always measurable and, 'even if a meaning can be given to the sum of a series of non-numerical "mathematical expectations", not every pair of such sums are numerically comparable in respect of more and less' (CWVIII, p. 344). According to Keynes (CWIX, p. 284), the philosophical problems about the application of mathematics and statistics to human conduct are not satisfactorily solved by resorting to MEU which 'deals with the present without any consideration for the fact that agents know very little about the future; so it is very difficult to make predictions about future facts'. In particular, statistics are built by assuming that past cases are certain; while uncertainty, when it is true, cannot ever be purely statistical (see Scazzieri, 2011).

5.1.1 Uncertainty and logical probability

We have seen in section 3 that well established literature deals with models of rational behaviour in situations where uncertainty is identified with risk. Keynes also dedicated much attention to this research field before writing *The General Theory of Employment, Interest and Money* (1936; CWIX), in the awareness that the scientific method cannot be well understood if the meaning of probability is not deeply investigated. In his *Principles of Probability* (1907, unpublished, chap. IV) Keynes distinguishes between risk (measurable uncertainty) and (non-measurable) uncertainty before Knight (1921), and in his *Treatise on probability* (1921, CWVIII, Italian translation in Pasquinelli and Marzetti, 1994) he expresses his theory of logical or inductive objective probability and his doctrine of rational intuition.

Since science needs a concept of probability not merely dependent on a valuation which may be different from subject to subject, Keynes presents his theory of probability as the general theory of rational thinking, because he has a unitary view of probability. For an extensive analysis of this theory we direct the reader to Keynes (1921, CWVIII), and Pasquinelli and Marzetti (1994, p. XXIV). We only highlight here that, considering probability a wider concept than those of frequency and subjective inductive probability, Keynes states that it is a degree of rational belief which is not necessarily measurable and comparable[8] (Keynes, ibid, chapters 1-3). More specifically, making reference to the probability of propositions instead of the probability of events, the appeal is to reason as source of knowledge, since Keynes' probability is a logical relation which represents a degree of rational belief established objectively in the sense that every agent in the same circumstances establishes the same probability. 'When once the facts are given which

determine our knowledge, what is probable or improbable in these circumstances has been fixed objectively, and is independent on our opinion' (Keynes, CWVIII, p. 4). Nevertheless, 'if our experience or our knowledge were incomplete we should be beyond the need of the calculus of probability. And where our experience is incomplete, we cannot hope to derive from it judgments of probability without the aid either of intuition or of some further *a priori* principle' (Keynes, 1921; CWVIII, p. 94) [9].

In addition, Keynes (1921, CW VIII) highlights that another aspect of probability has also to be considered: the weight of argument. The epistemological concept of *weight* measures the reliability of probability. It is the amount of relevant information available upon which a probability is established: if one argument is based on a greater amount of relevant evidence, it has more weight than another (see also the recent contributions by Levi, 2011, and Vercelli, 2011). According to Keynes (1921, CWVIII, p. 347) we have to doubt that 'a good whose probability can only be determined on a slight basis of evidence can be compared by means merely of the magnitude of this probability with another good whose likelihood is based on completer knowledge.'

5.1.2 What is right conduct when knowledge is not enough?

This research field was mainly developed starting from Jan Tinbergen's (1952) and Herbert Simon's (1955) writings. Nevertheless we believe that it also has its roots in Keynes' chapter 'The application of probability to conduct' of *A Treatise on Probability* (1921, pp. 339-356). Dealing with non-measurable uncertainty requires a concept of rationality which goes beyond that expressed by the MEU whether in the substantive or bounded version. In particular, we have seen that Keynes places emphasis on intuitive judgement.

The distinction between deliberate reasoning and intuition has raised the interest of many authors in the last decades (such as D. Kahneman, A. Tversky, and D. McFadden). Intuitive judgement is, in fact, more frequent than judgements produced by deliberate reasoning, since agents are in general observed making choices according to a limited number of heuristics 'which reduce the complex tasks of assessing probabilities and predicting values to simpler judgmental operations' (Kahneman, 2002, p. 483 and p. 465). Intuition represents all the forms of prior knowledge that guide agents' inductive inferences. In particular, when exploring the psychology of intuitive choices and examining the corresponding bounded rationality, Kahneman (2002, p. 541) highlights that 'the label "intuitive" is applied to judgements that directly reflect impressions', where impressions can be defined as opinions, ideas on facts, not grounded on certain elements and on logic reasoning but suggested by subjective impulses.

In Keynesian terms, if 'the question of a right action is *under all circumstances* a determinate

problem, it must be in virtue of an *intuitive judgement* directed to the situation as a whole, and not in virtue of an arithmetical deduction derived from a series of separate judgements directed to the individual alternatives each treated in isolation. More specifically, we must accept the conclusion that, if one good is greater than another, but the probability of attaining the first less than that of attaining the second, the question of which it is our duty to pursue may be indeterminate, unless we suppose it to be within our power to make direct quantitative judgements of probability and goodness jointly' (CWVIII, p. 345). In this way Keynes (CWX, p. 446) emphasizes 'the right to judge every individual case on its merits, and the wisdom, experience and self-control to do so successfully.' In addition, even if goodness and probability were measurable, the mathematical expectations of two alternative actions cannot be considered as the true measures of preferences because this method does not consider not only the weight of argument (see section 5.1.1) but also the moral risk. In particular, as regards *moral risk* the mathematical expectation procedure does not answer the following question: Is it certain that a larger good, which is extremely improbable, is precisely equivalent ethically to a smaller good which is proportionately more probable? Therefore, we have to doubt that the moral value of a speculative action and the moral value of a cautious action 'can be weighed against one another in a simple arithmetical way' (Keynes, CWVIII, p. 347).

This also means that, when moral good is non-measurable and non-comparable, and knowledge for establishing a numerical probability is not enough, we cannot rationalise our behaviour by resorting to the principle of indifference, or 'by arguing that to a man in a state of ignorance errors in either direction are equally probable, so that there remains a mean actuarial expectation based on equi-probabilities. For it can easily be shown that the assumption of arithmetically equal probabilities based on a state of ignorance leads to absurdities' (CWVII, p. 152)[10]. Since reason cannot be defeated if we do not know the numerical value of probability, Keynesian rationality is more comprehensive than Bayesian rationality. It can be applied to uncertain situations where Bayes' solution cannot be determined – i.e. when the existence of an *a priori* distribution cannot be postulated, or when, even if the existence of an *a priori* distribution can be assumed, it is unknown to the experimenter (Wald, 1950, p.16).

This firm belief influenced *The General Theory of Employment, Interest and Money* (CWVII), where Keynes deals with the complexities of economic relations considered as a whole, which may compel agents to behave in situations of non-measurable uncertainty. More specifically, the Keynesian formation of expectations about economic decisions affecting the future is considered in the short term and in the long term. In the short term, expectations generally have a high weight, because changes are mainly slow and each short term seems similar to the previous one. Since the

amount of available information is high, it is possible to arrive at a probable inductive generalisation. In the long term, instead, the amount of evidence is generally low, and so the weight of evidence is low, because there is no stability and expectations cannot be generalised through induction (Brady, 1987; Kregel and Nasica, 2011). Since our knowledge about long-term consequences is very vague and really uncertain, a rational basis for establishing numerical probability does not exist, so that mathematical expectation cannot be computed (Keynes, CWVII, chapter 12)[11].

In other words, Keynes, before Simon and Tinbergen, highlighted that the assumption of a calculable future wrongly interprets the principles of behaviour adopted in practice by agents, since it underestimates the situations in which they know very little or nothing and which determine doubt, precariousness and fear. Therefore, the Keynesian view about right conduct leads to procedural rationality. Recently, a number of uncertain situations, where probability is non-measurable and non-comparable, and the corresponding different models that can be taken as guide in order to behave rationally are analysed from a multidisciplinary point of view in Marzetti and Scazzieri (2011). In this book philosophers, statisticians, mathematicians and economists present theories and models about rational behaviour in conditions of uncertainty. They are guided by a pragmatic view of rationality, according to which effective strategies are identified.

5.2 *Rational dualism*

Our discussion about instrumental rationality highlights the distinction between two different and antagonist criteria of rationality: Bayesian reductionism and rational dualism (Mongin, 1984, p.11). In section 3 we have discussed how according to Bayesian reductionism agents can reduce 'uncertainty to the same calculable status as that of certainty itself' (Keynes, CWXIV, pp.112-3). In this section, we present how rational dualism works.

Rational dualism distinguishes situations: i) simple enough to be fully understandable by human mind, therefore decision-makers have reliable information and computing capabilities for applying the procedure of welfare maximisation (substantive rationality); and ii) complex enough to be not fully understandable, so that decision-makers have to simplify these situations in some rational way in order to make a choice (procedural rationality) since they do not have adequate information or computing capabilities for applying the maximisation procedure (Marzetti, 1998).

Procedural rationality is a 'wild' research field, where there are numerous possibilities to model agents' behaviour that lack information. The bounded rational agent described by Sargent is only one possible kind of bounded rational agent. Simon (1985, 1987) generally speaks of cognitive limitations to decision-making (internal constraints). Cognitive limitations mean that decision-

makers are never sure that a certain action will produce the maximum value. They cannot know, given certain circumstances, some of the conditions under which a specific action will determine its consequences, some of the consequences of these conditions, some of the events that will be influenced by the action in the future, and also the value of the action and that of some of its consequences. In addition, they cannot have information about all the possible alternative actions, and cannot know whether no other circumstances will interfere. This means that, as regards the structure of the model, the social welfare function and the representation of the economic system may be only partially known, or unknown. Furthermore, the model might be so complex that computational difficulties could frustrate agents' efforts.

When due to cognitive limitations the basis for computing a mathematical expectation does not exist, agents can resort to numerous practical procedures (heuristics) in order to behave rationally. In this case a decision depends not only on objectives and external constraints, but also on the procedure itself, which is the result of a process of choice. In particular, 'instead of assuming a fixed set of alternatives … we may postulate a process for generating alternatives. Instead of assuming known probability distributions of outcomes, we may introduce estimating procedures for them, or we may look for strategies for dealing with uncertainty that do not assume knowledge of probabilities. Instead of assuming the maximisation of a utility function, we may postulate a satisfying strategy' (Simon, 1985, p. 269; 1987, p.15).

5.2.1 From substantive rationality to bounded rationality: an example

In order to give an example of the passage from substantive rationality to bounded rationality, we consider the theory of economic policy by Tinbergen (1952, 1956), which distinguishes models of maximisation of social welfare (also named flexible objective model) from models whose aim is to reach numerically given objectives (fixed objective model), which represent cases of satisfying procedures.

I) Let us first consider a static situation of substantive rationality, where a policy-maker has all the information for maximising the social welfare. For sake of simplicity, let us assume that in some sense and to some extent welfare is numerically measurable and described by the function $V(\boldsymbol{y})$, where $\boldsymbol{y} \geq \mathbf{0}$ is a vector of target variables. Let us assume that the structure of the economic system $\boldsymbol{h}(\boldsymbol{y}) = \mathbf{0}$ is known. Therefore we write:

$$\max_{y} \; V(\boldsymbol{y}) \qquad (1)$$

$$\text{u.c.} \quad \boldsymbol{h}(\boldsymbol{y}) = \mathbf{0} \qquad (2)$$

$$\boldsymbol{y} \geq \mathbf{0}, \qquad (3)$$

where u.c. means 'under the constraint'. According to this model, the policy-maker will choose $\boldsymbol{y}$ in order to make $V(\boldsymbol{y})$ a maximum, given $\boldsymbol{h}(\boldsymbol{y}) = \mathbf{0}$.

II) Tinbergen (1952, pp.1-5) also recognises that in practice to estimate a social welfare function is a difficult matter, and claims that in general social welfare 'will not be considered consciously but intuitively by those responsible for the policy. In principle, it must not only depend on individual ophelimity functions, ..., but on a certain measure of combining and hence the weighting of these individual "interests" as well. In practice, the stage of fixing [the welfare function] and trying to maximise it will often be passed over and the targets chosen directly.'

Let us assume that rationality is limited by lack of data for estimating $V(\boldsymbol{y})$, while $\boldsymbol{h}(\boldsymbol{y}) = \mathbf{0}$ is known. In this case model (1)-(3) cannot be applied. One procedure to be applied is that of the fixed target, which consists in the choice of a satisfying value for a certain number of target variables. Let us assume that $\boldsymbol{y}$ is distinguished in a subset of target variables $\boldsymbol{x}$ and instruments $\boldsymbol{u}$, therefore $\boldsymbol{h}(\boldsymbol{y}) = \boldsymbol{h}(\boldsymbol{x}, \boldsymbol{u}) = \mathbf{0}$, and that $\boldsymbol{x}^*$ is a vector of desired or satisfying value fixed *a priori*, therefore $\boldsymbol{x} = \boldsymbol{x}^*$. In this case the maximisation procedure is substituted with a satisfying procedure as follows:

$$\boldsymbol{h}(\boldsymbol{y}) = \boldsymbol{h}(\boldsymbol{x}, \boldsymbol{u}) = \mathbf{0}, \qquad (4)$$

$$\boldsymbol{x} = \boldsymbol{x}^*. \qquad (5)$$

Given $\boldsymbol{x} = \boldsymbol{x}^*$, the policy-making procedure consists in finding the values of instruments $\boldsymbol{u}$ which solve the system $\boldsymbol{h}(\boldsymbol{x}^*, \boldsymbol{u}) = \mathbf{0}$.

This procedure is used in many Keynesian models. Keynes (CWXIV, p.114) highlights that the practical man/woman in order to meet a minimum rationality requirement may ignore the prospect of future changes about which s/he does not know anything, and assumes that 'the present is a much more serviceable guide to the future than a candid examination of past experience'.

III) The procedure of fixed targets leaves some questions unsolved. In particular, how must the policy-maker behave when model (4)-(5) has more than one solution, or has no solution? In these cases the approximate optimisation procedure can be applied, which consists in the search for the best approximation of the desired fixed target $\boldsymbol{x}^*$, and therefore requires the use of a welfare loss function $L(\boldsymbol{x} - \boldsymbol{x}^*, \boldsymbol{u})$. The model is as follows:

$$\min_{u} \; L(\boldsymbol{x} - \boldsymbol{x}^*, \boldsymbol{u}) \qquad (6)$$

$$\text{u.c.} \quad \boldsymbol{h}(\boldsymbol{x}, \boldsymbol{u}) = \mathbf{0} \qquad (7)$$

$$\boldsymbol{u} \geq \mathbf{0}. \qquad (8)$$

The policy-maker will choose $\boldsymbol{u}$ in order to make the value of $L(\boldsymbol{x} - \boldsymbol{x}^*, \boldsymbol{u})$ a minimum**,** where $\boldsymbol{x} - \boldsymbol{x}^*$ is the difference between the actual value $\boldsymbol{x}$ and the desired value $\boldsymbol{x}^*$ (Preston and Pagan, 1982; Marzetti, 1998).

5.2.2 *Other procedures: intuitive and conventional judgements*

We have shown that in economics the conception of rationality is problematic. Not only in very few cases do agents behave according to substantive rationality, but procedural rationality represents a rich psychological world of behavioural ideas and models, which cannot always be ordered according to their degree of rationality. In fact, the procedures presented in the previous section do not exhaust the content of the real world.

Today economists and psychologists also speak of ecological rationality, which stresses that agents are adaptive to the social environment in which they act. Ecological reasons describe not only bounded behaviours according to nature and source of uncertainty in order to produce a choice, but also human interactions which determine conventions, norms, and rules (Smith, 2003). Therefore, it is admitted that in ill-defined situations, common sense could resort not only to intuitive judgment but also to conventional judgment. Social and economic life is also regulated by conventions, which are patterns of behaviour that are 'customary, expected and self-enforcing' since they are shared and sustained by other people (Young, 1996, p.105). In Keynesian term, when agents are aware that their individual judgment is worthless, they 'fall back on the judgment of the rest of the world which is better well informed. That is, [they] endeavour to conform with the behaviour of the majority or the average' (Keynes, CWXIV, p.114).

6. **Discussion: A general theory of welfare (GTW)**

Since the moral values of society have to be rationally pursued, we have shown that welfare theories cannot be classified according to a sole conception of moral value, and a sole kind of right conduct.

Nevertheless, as Russell (1954, pp.100-107) highlights, a rational choice between competing moral systems cannot be made since 'a genuine difference exists as to ends', and it is not possible 'to advocate any argument in favour of the one against the other', because 'what a man will consider to constitute his happiness depends upon his passions, and these in turn depend upon his education and social circumstances as well as upon his congenital endowment'. Nor, as Carnap (1952, pp. 5 and 272-4) highlights, are there elements for rationally establishing that one concept of probability is more right than the other, since the inductive conception is used in the methodology of science while the mathematical conception is used in statistics.

This awareness leads us to think in terms of a GTW. From the point of view of moral values, it must admit all the possible values in which a society can believe in all possible situations. This means that, not only subjective values have to be admitted, but also objective values. From the point of view of models in which GTW expresses itself, we believe that it is a branch of logic. Logic is

intended here in a wider sense than mathematical logic, because it is not only concerned with deductive arguments but also with inductive reasoning. In other terms, as regards instrumental rationality, GTW must be based on *rational dualism*, which claims that when it is not possible to obtain knowledge for applying the MEU procedure, other procedures must be admitted in order to make rational decisions, and these procedures may, or may not, be represented through mathematical models.

In order to present the issue through some actual cases, we make reference to policy-maker's practical capability of pursuing a sustainable social welfare (Marzetti, 2007). Therefore, we focus on values on which sustainable welfare may be based. Today, in order to pursue this aim, environmental policy not only recognises the intrinsic objective value of nature (Bellamy and Johnson, 2000) but, according to the specific situation, it makes reference to either substantive rationality or bounded rationality (Steyaert *et al*, 2007). For the sake of simplicity, we make reference to mathematically representable situations.

6.1 *Subjective values*

As regards subjective values, an actual situation of social welfare cardinally measurable is represented by the application of cost-benefit analysis (CBA) to a project for the conservation of a given natural resource (weak sustainability). According to CBA, not only benefits and costs measured through market prices have to be considered, but also nonmarket benefits and costs must be considered and evaluated in monetary terms, such as the use free of charge of the resource (use value), and its non-use values, such as option value, bequest value and existence value (Turner, 1999). These non-market values, which make reference to individual preferences, can be estimated through a good design of a contingent valuation survey, the aim of which is to find out the willingness to pay (WTP) of the relevant population for the conservation of that resource (McFadden, 1999; Polomé, Marzetti, Van der Veen, 2005). The sum of the aggregated marketable and non-marketable values is a cardinal measure of the social welfare from that resource. A situation of ordinally measurable preferences, instead, is that in which preferences are measured through a five-point Likert-type response scale (Whisman and Hollenhorst, 1998). Scores range from 1 (strongly non-preferred) to 5 (strongly preferred). A composite measure of social welfare can be created by averaging scores on a certain number of items which contribute to welfare, such as level of crowding, environmental quality, social experience and facilities. In these cases a social welfare function can be estimated and, when probabilities and constraints are known, the maximisation procedure can be applied.

6.2. *Objective values*

Sustainability intended in strong sense stresses the importance to manage natural resources taking into account also their PV, or the value of ecosystems as a whole. As Bellamy and Johnson (2000, p. 267) highlight, the new paradigm of Integrated Resource Management (IRM)[12] recognises Moore's concept of 'the whole being more than the sum of the parts' and the 'diversity in values relating to natural resources'. Since PV is independent of individual's preferences, it is non-measurable. We have seen that Keynes' macroeconomics is conceived in the awareness that policy-makers have to organise the material welfare in order to promote the ethical good, which may be also intended as ideal. In order to see how a macroeconomic model works when objective non-measurable values are admitted, let us consider the following situation: i) PV of natural resources is recognised; ii) present agents can only perceive this organic value by intuition, and in spite of this they have to behave rightly in order to respect future generations' rights about natural resources; and iii) probabilities are numerically unknown, since there is very little or no experience about impacts of economic activities on natural environment. Under these conditions, the maximisation procedure cannot be applied.

Since PV is non-measurable, it cannot be represented through a welfare function, therefore it is rational to consider environmental physical indicators as *intermediate targets* or fixed targets, the reaching of which favours the pursuit of the PV conservation. In order to give an example, let us focus on pollution the reduction of which improves environmental quality and the functioning of the natural system considered as a whole. Let us also consider the following simple static input-output model by Leontief (1980, pp. 86-87):

$$y_1 = a y_1 + b y_2 + c_1, \qquad (9)$$

$$y_2 = c y_1 + d y_2 + e y_3 + c_2, \qquad (10)$$

$$z = f y_1 + g y_2 - y_3, \qquad (11)$$

$$L = h y_1 + i y_2 + m y_3, \qquad (12)$$

where y_1 is the agricultural production, y_2 industrial production, y_3 pollution eliminated through the industrial process of recycling, z the total quantity of pollution after waste recycling, c_1 and c_2 consumptions of agricultural and industrial goods respectively, L employment, and the other symbols are known coefficients. Equations (9) and (10) describe the output levels of agricultural and industrial sectors respectively. The net total pollution is represented by equation (11), which shows that pollution is the result of the production of agricultural and industrial goods, and it is reduced through recycling. Finally, equation (12) shows that the industrial process of recycling increases employment.

Let us use this model according the logic of model (4) – (5). Let us consider as fixed intermediate targets a given level of total pollution, the control of which is needed for pursuing the PV objective, and a given level of employment as follows:

$$z = \acute{z} \quad \text{and} \quad L = \acute{L}, \qquad (13)$$

where $\acute{z}$ is a fixed level of net total pollution, established according to the available scientific knowledge, and $\acute{L}$ is the established level of employment to be pursued by means of two instruments: c_2 and y_3. The solution of model (9)–(13) is given by those levels of c_2 and y_3 that satisfy $z = \acute{z}$ and $L = \acute{L}$.

Model (6)–(8) can also applied in this case. The solution is given by the values of instruments which minimize the difference between the actual values and the desired values of intermediate targets.

7. **Conclusion**

Our analysis of different welfare theories has highlighted that they cannot be classified according to a sole moral criterion, and a sole kind of instrumental rationality. As regards moral values, utilitarianism, NWE, TSC, RU and growth model based on altruism or moral obligations are based on ethics of motive, which only consider subjective values assumed to be cardinally or ordinally measurable; while Keynes' welfare theory is grounded in ethics of end, which also admits the rational choice of moral values assumed to be not always measurable.

As regards right conduct, when subjective probability is assumed to be equal to objective probability, welfare theories based on the ethics of motive are cases of substantive rationality because they describe agents' behaviour in a situation of complete information about consequences and probability. When these theories admit bounded rationality, subjective probabilities are assumed to be different from objective probabilities, and learning has the task of creating the condition for the convergence of subjective probabilities to objective probabilities; on the other hand, when there is not enough knowledge for establishing subjective numerical probabilities, the principle of indifference should be applied. Keynes's macroeconomics, instead, also admits other situations of bounded rationality by recognising that agents may act under conditions of non-measurable uncertainty, such as intermediate objectives, intuitive judgment and conventional judgment, since moral goods may be non-measurable and, when numerical probabilities are non-measurable and non-comparable, the principle of indifference leads to absurdities.

A rational choice between competing moral systems cannot be made, nor can we say that the objective (mathematical) concept of probability is more right than the inductive concept, and viceversa. Therefore, a GTW is needed, which admits all the possible values in which a society can

believe and, as regards instrumental rationality, is based on rational dualism because agents may not have adequate information and the computing capability for applying the maximisation procedure. Maximisation models are applied when situations are simple enough to be fully understandable; while models of bounded or procedural rationality are appropriate when a solution has to be found for more complex problems, only partially understandable, such as many practical situations about environmental management where conditions of non-measurable uncertainty are present.

Notes

[1] This study was presented at the conference 'Challenging Models in the Face of Uncertainty', 28-30 September 2010, Cambridge, UK. Another version of it is published in Marzetti Dall'Aste Brandolini S. and Scazzieri R. (eds.) (2011), *Fundamental Uncertainty. Rationality and Plausible Reasoning*, Palgrave Macmillan, Basingstoke and New York, with the title 'Moral Good and Right Conduct: A General Theory of Welfare under Uncertainty'.

[2] Examples of social welfare functions W cardinally measurable and additive are those where individual utility $U_i(\boldsymbol{x})$, $i = 1, ..., n$ individuals, $\boldsymbol{x}$ bundle of goods, is assumed to be measured i) by individual income, Y_i, therefore, $U_i(\boldsymbol{x}) = Y_i$, and $W = Y_1 + Y_2 + ... + Y_n$, or ii) by average per capita income, therefore $W = (Y_1 + Y_2 + ... + Y_n)/n$. In the welfare function by Amartya Sen (1973) average per capita income is weighed by a measure of income distribution unequality, therefore $W_{Gini} = [(Y_1 + Y_2 + ... + Y_n)/n] (1 - G)]$, where G is the Gini's index which assumes values from 0 and 1 (0 = full equality, 1 = maximun unequality).

[3] Responsibility means the possibility of foreseeing the consequences of an action and correcting the action itself according to the prediction. Therefore, it is based on the notion of choice and on limited freedom.

[4] Rawls (1999, pp. 3-9 and p. 266) considers justice the first virtue of social institutions. He constructs his theory of justice by establishing two principles of justice which individuals ought to select by means of the majority rule in order to govern society: i) 'Each person is to have an equal right to the most extensive total system of equal basic liberties compatible with a similar system of liberty for all'; ii) social and economic inequalities are to be arranged so that they are both (a) to the greatest benefit of the least advantaged, consistent with the just savings principle, and (b) attached to offices and positions open to all under conditions of fair equality of opportunity.' As regards justice between generations.

[5] In a static situation, the REH equilibrium is that of a perfect competition model where all the agents have the same information set because they know the structure of the model and the true value of parameters. In a dynamic situation, instead, it is assumed that agents behave in recurring

situations, which they have experimented before. Therefore, they know the laws which govern the economic system, and their forecasts are correct estimates of its future trend.

[6] Von Neumann and Morgenstern (1947, p.19) justify this choice by highlighting that 'probability has often been visualized as a subjective concept more or less in the nature of an estimation. Since we propose to use it in constructing an individual numerical estimation of utility, the above view of probability would not serve our purpose. The simplest procedure is, therefore, to insist upon the alternative perfectly well founded interpretation of probability as frequency in long runs. This gives directly the necessary numerical foothold'.

[7] Amongst alternative actions, the one which will generally produce the expected greatest *good* - identified with the ideal - must be found. This is the 'ideal utilitarianism'. The pursuit of the greatest good is favoured by the general observance of rules or actions of general utility, such as the respect of liberty and private property, laboriousness, and temperance. When rules or actions are proved to be of general utility, an agent 'should *always* perform them; but in other cases ... he should rather judge of the probable results in his particular case, guided by a correct conception of what things are intrinsically good or bad' (Moore, 1959, p.181). According to Moore, judgements based on frequencies should be the only cases of probability which have logical relevance.

[8] On p. 4 of his Treatise on Probability (1921, CWVIII) Keynes writes: 'Let our premises consist of any set of propositions *h*, and our conclusion consist of any set of propositions *a*, then, if a knowledge of *h* justifies a rational belief in *a* of degree α, we say that there is a probability-relation of degree α between *a* and *h*.' And on p.35 he specifies that 'it would be difficult to maintain that there is no logical relation whatever between our premiss and our conclusion in those cases where we cannot assign a numerical value to the probability'.

[9] An economic example of this measurability issue is given by Russell (1948, Part V, chap.1). Let us consider the probability that a given insurance is for an agent a good business. His/her problem is different from that of the insurance company, which offers an insurance to all the components of a certain class of individuals and it needs to know the statistical mean and not the individual case. An individual, instead, may have personal reasons to expect a more or less long life. His/her health conditions and the characteristics of his/her way of life are important, and some of these may be so rare that the help of statistics is unreliable. In addition, a doctor may not be able to give a scientific judgement of personal health conditions. In this case, the probability that taking out insurance is a good business for him/her is something very vague and absolutely impossible to measure numerically.

[10] Franklin (2001, p. 279) explains the problem as follow: 'To take the simplest kind of example, if there are three kinds of balls in an urn, white, red and blue, what is the initial probability that a ball

to be drawn will be white? Is it 1/3 (because it could as easily be either white, red or blue) or ½ (because it could as easily be white or non-white)?' Also see Maher (2006).

[11] In chapter 12 of the *General Theory* (CWVII) Keynes specifies that agent's decision making in conditions of non-measurable uncertainty does not depend on 'waves of irrational psychology' but rather on *animal spirits* intended as 'the spontaneous urge to action than inaction'. (See Kregel and Nasica, 2011, pp. 286-287).

[12] IRM is the result of the failure of the traditional rational planning approach based on scientific and technical methods sectorally applied to the multiple uses of natural resources.

References

Arrow K. J. (1951), *Social Choice and Individual Values*, New York , J. Wiley & Sons .

Asheim G.B.(1996), 'Ethical Preferences in the Presence of resource Constraints', *Nordic Journal of Political Economy*, 23 (1), pp.55-67.

Asheim G.B. and Buchholz W (2003), The Malleability of Undiscounted Utilitarianism as a Criterion of Intergenerational Justice, *Economica*, 70, pp. 405-422

Bellamy J. A., and Johnson A. K. L. (2000), 'Integrated resources management: moving from rhetoric to practice in Australian agricultural', *Environmental Management*, 25(3), pp. 265-280.

Bentham J.(1948), *A Fragment on Government and an Introduction to the Principles on Moral and Legislation*, Oxford, Basil Blackwell (1st ed. 1789).

Bergson A. (1938), 'A Reformulation of Certain aspects of Welfare Economics', in *Quarterly Journal of Economics*, 52 (February), pp. 310-34.

Birks T.R. (1874), *Modern Utilitarianism*, London, Macmillan and Co.

Brady M. E. (1987), 'J. M. Keynes' "Theory of Evidential Weight": Its Relation to Information Processing Theory and Application in the General Theory', *Synthese*, vol. 71, April, pp. 37-59.

Brink D. (1993), 'The Separateness of Persons, Distributive Norms, and Moral Theory', in Frey R.G. and Morris C.W. (eds.), *Value, Welfare and Morality*, Cambridge, Cambridge: University Press, pp. 252-89.

Carnap R. (1952), *The Continuum of Inductive Method*, Chicago, The University of Chicago Press.

Chichilnisky G. (1997), 'What is Sustainable Development', *Land Economics*, 73, pp. 467- 491.

Day R. H. (1975), *Adaptive Processes and Economic Theory*, in Day R. H. and Groves T. (eds.), *Adaptive Economic Models*, New York , Academic Press.

Dasgupta P. and Heal G. (1974), 'The optimal Depletion of Exhaustible Resources', *Review of Economic Studies*, 45, p. 3-28.

Dubois D., Fargier H. and Perny P. (2003), Qualitative Decision Theory with Preference Relations and Comparative Uncertainty: An Axiomatic Approach', *Artificial Intelligence*, 148, pp.2019-260.

Franklin J. (2001), 'Resurrecting Logical Probability', *Erkenntnis*, 55, pp.277- 305.

Faucheux S. and Froger G. (1995), 'Decision-making under environmental uncertainty', *Ecological Economics*, 15, pp. 29-42.

de Finetti B. (1938), 'Probabilisti di Cambridge', *Supplemento Statistico ai Nuovi Problemi di Politica, Storia ed Economia*, 4, II, n° I, Ferrara, pp. 21-37.

Fitzgibbons A. (1988), *Keynes' Vision*, Oxford, Claredon Press.

Gruchy A. G. (1947-8), 'The Philosophical Basis of the New Keynesian Economics', *Ethics*, 58(4), pp. 235-44.

Harsanyi J.C. (1958), 'Ethics in Terms of Hypothetical Imperatives', *Mind*, 67 (267), pp. 289-316.

- (1976), *Essays on Ethics, Social Behaviour, and Scientific Explanation*, Dordrecht , Reidel Publishing Company.
- (1986), 'Utilitarian Morality in a World of Very Half-hearted Altruists', in W. P. Heller, R. M. Starr and D. A. Starret (eds), *Social Choice and Public Decision Making, Cambridge*, Cambridge University Press, pp. 57-73.
-

Hartwick J.M. (1977), 'Intergenerational Equity and the Investing of Rents from Exhaustible Resources', *The American Economic Review*, 67(5), pp. 972-974.

Hicks, R. (1939), 'Foundations of Welfare Economics', *Economic Journal*, XLIX, pp. 696-712.

Howarth B.H. (1995), 'Sustainability under Uncertainty: A Deontological Approach', *Land Economics*, 71 (4), pp. 417-27.

Hume D. (1910), *An Enquiry Concerning Human Understanding*, Harvard Classics , vol. 37, New York ,P.F. Collier & Son.

Jonas H. (1974), 'Technology and Responsibility: Reflections on the New Tasks of Ethics', in *Philosophical Essays. From Ancient Creed to Technological Man*, Chicago, The University of Chicago Press.

Kaldor N. (1939), 'Welfare Proposition in Economics', *Economic Journal*, 45, pp. 549-52.

Kahneman D. (2002), 'Maps of Bounded Rationality: A Perspective on Intuitive Judgement and Choice', Nobel *Prize Lecture*, December 8, 2002.

Keynes J.M. (1904a), 'Ethics in Relation to Conduct', *The J.M. Keynes Papers*, UA/19/2, King's College Library, Cambridge.
- (1904b), 'The Political Doctrine of Edmund Burke', *The J.M. Keynes Papers*, UA/20/3, King's College Library, Cambridge.
- (1905), 'Miscellanea Ethica', *The J.M. Keynes Papers*, UA/21, King's College Library, Cambridge.

- (1906), 'Egoism', *The J.M. Keynes Papers*, UA/26, King's College Library, Cambridge.
- (1907), 'The Principles of Probability', *The J.M. Keynes Papers*, TP/A/1, Cambridge, King's College Library.
- (1921), *A Treatise on Probability*, London, Macmillan Co. Italian translation by Pasquinelli A. and Marzetti S. (1994), *Trattato sulla probabilità*, Bologna, CLUEB.
- (1936), The General Theory of Employment, Interest and Money, vol. VII of The Collected Writings of John Maynard Keynes, London, Macmillan.
- (1971-89) *The Collected Writing of J.M. Keynes* (*CW*), vols. I – XXX, Johnson E. and Moggridge K. (eds), London, Macmillan.

Knight E. H. (1921), *Risk, Uncertainty and Profit*, London, Houghton Mifflin Company.

Kregel J. and Nasica E. (20011), 'Uncertainty and Rationality: Keynes and Modern Economics', in Marzetti Dall'Aste Brandolini S. and Scazzieri R. (2011) (eds), *Fundamental Uncertainty: Rationality and Plausible Reasoning*, Palgrave Macmillan, CPI Antony Rowe, Chippenham and Eastbourne, GB, pp. 272 – 293.

Leontief W. (1980), *Teorie, modelli e politiche in economia*, Milan, Etas libri.

Levi I. (2011), 'The Weight of Argument', in Marzetti Dall'Aste Brandolini S. and Scazzieri R. (eds), *Fundamental Uncertainty. Rationality and Plausible Reasoning*, Basingstoke and New York, Palgrave Macmillan, pp. 39-58.

Maher P. (2006), 'The Concept of Inductive Probability', *Erkenntnis*, 65, pp. 185-206.

Marzetti Dall'Aste Brandolini S. (1998), 'Il comportamento razionale del policy-maker', *Economia Politica*, XV (3), pp. 475-517.
- (1999), 'Bene morale e condotta giusta: la politica economica di J. M. Keynes', in Marzetti Dall'Aste Brandolini S. and Scazzieri R. (eds), *La probabilità in Keynes: premesse e influenze*, CLUEB, Bologna, pp. 139-87.
- (2001), 'La scienza economica come scienza morale: Dualismo etico ed economia del benessere', in Fano V., Tarozzi G. and Stanzione M., *Prospettive della logica e della filosofia della scienza*, Atti del Convegno Triennale della Società Italiana di Logica e Filosofia della Scienza, Cesena e Urbino, 15-19 febbraio, 1999, Catanzaro, Rubbettino Editore.
- (2007), 'Happiness and Sustainability: a Modern Paradox', in Bruni L. and Porta P.L.(eds), *Handbook in the Economics of Happiness*, Cheltenham, UK, Edward Elgar, pp. 512-531.
- (2011), 'Moral Good and Right Conduct: A General Theory of Welfare under Fundamental Uncertainty', in Marzetti Dall'Aste Brandolini S. and Scazzieri R. (2011) (eds), *Fundamental Uncertainty: Rationality and Plausible Reasoning*, Palgrave Macmillan, CPI Antony Rowe, Chippenham and Eastbourne, GB, pp. 294-329.

Marzetti Dall'Aste Brandolini S. and Scazzieri R. (2011), (eds), *Fundamental Uncertainty: Rationality and Plausible Reasoning*, Palgrave Macmillan, CPI Antony Rowe, Chippenham and Eastbourne, GB, pp. 1 – 348.

McFadden D. (1999), 'Rationality to Economics', *Journal of Risk and Uncertainty*, 19(1-3), pp.73-105.

Meadows D. H., Meadows D. L., Randers J. and Beherens III W. W. (1972), *The Limits of Growth*: *a Report for the Club of Rome's Project on the Predicament of Mankind*, Universe Book, New York.

Mittelhammer R.C., Judge G.G. and Miller D.J. (2000), *Econometric Foundations*, Cambridge, Cambridge University Press.

Mongin P. (1984), 'Modèle Rationnel ou Modèle Économique de la Rationalité?', *Revue économique*, 35 (1), pp. 9-63.

Moore G.E. (1959, first ed.1903), *Principia Ethica*, Cambridge, Cambridge University Press.

- (1966), *Ethics*, London , Oxford University Press, (1st ed. 1912).

Muth J. (1961), 'Rational Expectations and the Theory of Price Movement', *Econometrica*, 29 (3), pp. 315-35.

von Neumann J. and Morgenstern O. (1947), *Theory of Games and Economic Behaviour*, Princeton, Princeton University Press.

Pesaran M. H. (1987), *The Limits to Rational Expectations*, Oxford , Basil Blackwell.

Pareto V. (1964), *Cours d'économie politique*, Librairie Droz, Geneva (1st ed. 1896).

Parfit D. (1982), 'Future Generations: Further Problems', *Philosophy and Public Affairs*, 2, pp. 113-72.

Pezzey J.C.V. (1997), 'Sustainability Constraints versus "Optimality" versus Intertemporal Concern, and Axioms versus Data, *Land Economics*, 73 (4), pp. 448-66.

Polomé P, Marzetti S. and van der Veen A. (2005), 'Economic and Social Demands for Coastal Protection', *Coastal Engineering*, Vol. 52, No. 10-11, pp. 819-40.

Popper K. R. (1957), *The Poverty of Historicism*, London , Routledge & Kegan Paul.

Preston A. J. and Pagan A. R. (1982), *The Theory of Economic Policy*, Cambridge, Cambridge University Press.

Ramsey F.P. (1931), Truth and probability', in *The Foundation of mathematics and Other Logical Essays*, Bruce and Co., New York, Harcourt.

Rawls J.(1999, first published 1971), A Theory of Justice, Revised Edition, Oxford: Oxford University Press.

Robbins L. (1984), *An Essay on the Nature and Significance of Economic Science*, London, Macmillan (3rd ed.).

Russell B. (1948), Human *Knowledge: Its Scope and Limits*, London, Allen & Unwin.
- (1954), *Human Society in Ethics and Politics*, London, Allen & Unwin.

Sargent T. J. (1993), *Bounded Rationality in Macroeconomics*, Oxford, Clarendon Press.

Savage L.J. (1954), *The Foundations of Statistics*, Wiley and Sons Inc., New York.

Scazzieri R. (2011), A Theory of Similarity and Uncertainty, in Marzetti Dall'Aste Brandolini S. and Scazzieri R. (2011) (eds), *Fundamental Uncertainty: Rationality and Plausible Reasoning*, Palgrave Macmillan, CPI Antony Rowe, Chippenham and Eastbourne, GB, pp. 73-103.

Sen A. (1997, 1rst ed. 1973), *On Economic Inequality*, Oxford, Claredon Press.

Simon H. A. (1955), 'A Behavioral Model of Rational Choice', *The Quarterly Journal of Economics*, 69, pp. 99-118.
- (1978), 'Rationality as Process and Product of Thought', *The American Economic Review*, 68(2), pp.1-16.
- (1985) *Causalità, razionalità, organizzazione*, Bologna , Il Mulino.
- (1987) 'Bounded Rationality?', in Eatwell J., Milgate M., and Newman P. (eds.), *The New Palgrave: Utility and Probability*, London, Macmillan, pp. 15-18.

Skidelsky R. (1983), *J.M. Keynes*, *Hopes Betrayed* 1883-1920, vol. I, London, Macmillan.

Solow R. (1974), 'Intergenerational Equity and Exhaustible Resources', *The Review of Economic Studies*, 41, pp. 29-45.

Steyaert P., Barzman M., Billaud J.P., Brives H., Hubert B., Olivier G., Roche B. (2007), 'The role of knowledge and research in facilitating social learning among stakeholders in natural resoutces management in the French Atlantic coastal wetlands', *Environmental Science and Policy*, 10, pp. 537-550.

Temkin L. (1993) 'Harmful Goods, Harmless Bads', in Frey R.G. and Morris C.W. (eds.), *Value, Welfare and Morality*, Cambridge, Cambridge University Press, pp. 290-324.

Tinbergen J. (1952), *On the Theory of Economic Policy*, Amsterdam, North Holland.
- (1956), *Economic Policy: Principles and Design*, Amsterdam, North-Holland.

Turner R. K. (1999), "The place of economic values in environmental valuation", in Bateman I.J. and Willis K.G., *Valuing Environmental Preferences*, Oxford University Press, Oxford, ch. 2.

Vercelli A. (2011), 'Weight of Argument and Economic Decisions', in Marzetti Dall'Aste Brandolini S. and Scazzieri R. (eds), *Fundamental Uncertainty. Rationality and Plausible Reasoning*, Basingstoke and New York, Palgrave Macmillan, pp. 151-170.

Vigna C. (2001), 'Presentazione' in *Introduzione all'etica*, Milan, Vita e pensiero, pp. I – IX.

Wald A. (1950), *Statistical Decision Functions*, New York, J. Wiley & Sons.

Weikard H.P. (2002), 'Diversity Functions and the Value of Biodiversity', *Land Economics*, 78(1), pp. 20-27.

Whishman S. A. and Hollenhorst S. J. (1998), 'A Path Model of Whitewater Boating Satisfaction on the Cheast River of West Virginia', *Environmental Management*, 22(1), pp. 109-17.

Young P. H. (1996), 'The Economics of Conventions', *The Journal of Economic Perspectives*, 10(2), pp.105-122.