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KEYNES'S APPROACH TO MACROECONOMIC MODELLING: A POPPERIAN
RECONSTRUCTION

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MAINSTREAM MACROECONOMICS IN THE LIGHT OF POPPER

Abstract:

We review Keynes's attempt to deal with the 'problem of induction' since his *Treatise on Probability* and then argue that Popper's 'solution' to the former, known as Popper's evolutionary of knowledge and learning, is compatible with Keynes's adoption of a conventional theory of knowledge in his later economic writings. We also argue that Keynes's macro-theory as it appears in both his *General Theory* and his 1937 QJE paper can be (re)interpreted as an instance of a reformulated version of the 'subjectivist' version of Popper's 'Rationality Principle' (RPs) according to which agents' behaviour is appropriate or adequate to the problem-situation as the theorist believes that agents believe the former is. A number of further results follow from the previous arguments.

Keywords: Popper, Keynes, Rationality Principle, Macro-models, and Induction

LA MODELIZACIÓN MACROECONÓMICA EN EL ENFOQUE KEYNESIANO: UNA RECONSTRUCCIÓN POPPERIANA

Resumen:

Repasamos el intento de Keynes de abordar el "problema de la inducción" en su *Treatise on Probability* y señalamos que la solución propuesta por Popper al mismo, conocido como la teoría popperiana del conocimiento y el aprendizaje es compatible con la adopción por parte de Keynes de una teoría convencionalista del conocimiento en su última etapa. También señalamos que la *Teoría General* y su artículo del año 1937 en el QJE pueden ser interpretados como un caso concreto de la versión 'subjectivista' del "Principio de Racionalidad" Popperiano, de acuerdo con el cual el comportamiento de los agentes económicos es adecuado al problema-situación tal y como el modelizador cree que los agentes perciben este último. De esta interpretación obtenemos una serie de resultados adicionales.

Palabras clave: Popper, Keynes, principio de racionalidad, modelos macroeconómicos e inducción.

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Keynes's Approach to Macroeconomic Modelling: a Popperian Reconstruction

'Orthodoxy is the death of knowledge, since the growth of knowledge depends entirely on the existence of disagreement' (K. Popper, *The Myth of the Framework: In defence of science and rationality*, 1994, p. 34).

1. Introduction

As we showed in the previous essay, Hume was sceptical about the rationality of human behaviour since he believed that individual behaviour was grounded on 'custom and habit', that is, on the assumption that the 'future resembles the past' in spite of the inexistence of an 'inductive logic'. This paradoxical situation was denoted by Hume as the 'problem of induction'. Hume's philosophical analysis remained unchallenged for more than two hundred years as Keynes (1920, pp. 303-04) recognized. In the previous essay we discussed the 'solution' to the problem of induction propounded by Popper which we denoted as Popper's evolutionary theory of knowledge and learning (PTKL). However, the focus of our discussion was not so much on PTKL itself as on the tension with Popper's methodological proposal for the social sciences referred to as 'Situational Analysis' (SA). Chronologically, there is a prior-to-Popper attempt to provide a solution to Hume's 'problem of induction': Keynes's (failed) attempt to construct an objective epistemological theory of probability in his *Treatise on Probability* (Keynes, 1920). As we will see, Keynes's aim was not to only to answer Hume but to answer Cambridge philosopher G. E. Moore (1993[1903]) who argued that the highest expected 'good' would result if individual behaviour consisted of following rules insofar as the latter represent the accumulated knowledge in our society. Keynes's proposal to solve the 'problem of induction' in his *Treatise* consists of replacing the notion of 'certain' knowledge, which Hume showed to be unattainable, by the notion of 'probabilistic' knowledge. Keynes's main argument was that, though we cannot attain the former, we can nevertheless attain the latter if only we adopt inductive procedures. The main innovation in the *Treatise on Probability* are logical probability relations. As Andrews (1999) notes, the latter look like Platonic Universals in the sense that they exist in a 'logical space', are independent of individual opinions and can only be discovered via intuition. In the *Treatise*, Keynes proposes an objective epistemological theory of probability. As we will see below, such proposal is grounded upon an inductive theory

of knowledge and learning. However, the notion of logical probability relations was criticized by Ramsey (1978[1931]) in his *Truth & Probability* and Keynes ended up yielding to Ramsey's criticisms in 'My Early Beliefs' published in 1938 (Keynes, 1973a, p. 445).

Next, the textual evidence suggests that by the second half of the 1930s Keynes had abandoned most of the ideas he had advocated in the *Treatise* and adopted instead a pragmatic approach to human behaviour which, as we shall show below, is remarkably similar to Hume's views. Indeed, Keynes's attempt to solve the 'problem of induction' in his *Treatise* was a failure and this ultimately forced him to return to the point where Hume had left off about two hundred years earlier. The return to Hume is transcendental for the methodology of economics since, as some commentators recognize, Keynes's later economic writings are based on a theory of human nature that is similar to Hume's (Davis, 1994; Andrews, 1999). Therefore, we take Hume's theory of human nature as a key feature of Keynes's later economic writings, including the *General Theory* (Keynes, 1936) and his paper in the *Quarterly Journal of Economics* (Keynes, 1937). This view consists of the notion that people make decisions on the basis of inductive procedures which amount to adopting social rules and conventions which are widely believed to have worked well in the past. The rules and conventions Keynes refers to in his later economic writings are, for some purposes, equivalent to Hume's old idea that individual behaviour is grounded on 'custom and habit'. In particular, the chief convention of all, according to Keynes, is the assumption that 'the existing state of affairs will continue indefinitely, except in so far as we have specific reasons to expect a change' (Keynes, 1936, p. 152).

The next issue we address in the essay is the compatibility of Keynesian macro-theory with PTKL. This is an issue which, to the best of our knowledge, has not been addressed in the literature on Keynesian economics. We make several claims. First, the replacement of the assumption that economic agents assume, unless they have specific reasons to think otherwise, that the 'future will resemble the past' can be conceptualized in a way that makes Keynesian macro-theory congenial to PTKL. More specifically, we propound the notion of 'hegemonic' conjectures (HC) to denote the social conventions which are central to Keynes's macroeconomic analysis in his later economic writings. If we interpret HC as conjectures which are held *provisionally* by economic agents as long as the former believe that they provide valid guidelines upon which to ground decisions, then, it will be argued, the notion of HC provides a *link* between PTKL and Keynesian

theory. As our argument goes, HC will be kept as long as they yield good results and will be 'scrapped' if agents believe that this is no longer the case. This implies that HC exhibit an *evolutionary* dimension in that they are retained by economic agents as long as the former appear to aid decision-making in a context of genuine uncertainty yet they are replaced by other (new) HC if economic agents no longer believe they provide a valid basis for decision-making. Now, the replacement of 'old' HC will take place in the aftermath of the occurrence of a substantial discrepancy between expected and realized outcomes. This, in turn, will set off the search for new HC. We will denote the process of search for 'new' HC as a 'confidence' crisis in the sense that the 'old' HC have been abandoned but the 'new' HC have not yet emerged. Thus, we view 'confidence' crisis in a way that is, arguably, reminiscent of T. Kuhn's theory of scientific revolutions (Kuhn, 1962). Lastly, we argue there is a parallelism between the notion of 'confidence' crisis and the explanation of economic downturns in Keynes's macro-theory. In the latter, a downturn is heralded by the observation that there is a very large discrepancy between expected and realized outcomes. In turn, this brings about a fall in 'confidence' and an increase in liquidity preference. In short, we argue that the notion of HC provides a link between Keynes's macro-theory and Popper's theory of knowledge and learning in that, in both cases, the expansion of knowledge (conventional or otherwise) over time is the result of a process of trial and error-elimination.

Next, the convention that 'the existing state of affairs will continue indefinitely, except in so far as we have specific reasons to expect a change' is at the very core of Keynesian macro-theory and is, in turn, responsible for two criticisms Keynesian theory has frequently been subject to¹: (i) the alleged 'irrational' behaviour of the agents whose behaviour Keynesian models seek to capture, and (ii) the *nihilism* of Keynesian theory. To this, we may add another potential criticism that stems from the fact that, on the one hand, Keynes — in his criticism of the pioneering work of Tinbergen — argues that the use of statistical inference methods is valid in economics only if we can show that the probability distributions of economic variables exhibit a sufficient degree of stability over time whereas, on the other hand, his macro-theory is based upon the assumption that economic agents *believe*, unless they have good reasons to believe otherwise, that 'the existing state of affairs will continue indefinitely'.

Now, we will argue below that the three criticisms referred to above are a direct implication of the adoption by mainstream theoreticians of the 'objectivist' version of Popper's 'Rationality Principle' (*RPo*) we discussed in the previous chapter. First, we

argued in that chapter that the adoption of *RPO* implies that the theoretician reconstructs the problem-situation (P-S) 'as she believes it is'. In the case of mainstream theory, the former implies that agents are assumed to exhibit 'ends-rationality', 'means-rationality' and, 'beliefs-rationality'. Now, the assumption of 'beliefs-rationality' implies, in turn, that economic agents' view of P-S is assumed to be similar to the theoretician's. In such circumstances, the theoretician can 'close' the model in a way that a number of testable predictions can be extracted. Now, we argue below that mainstream economists assess Keynes's theory under the (often implicit) assumption that there must be a 'coincidence' between the agents' and the theoreticians' view of P-S. Thus, if the theoretician does *not* believe that 'the future will resemble the past' — as Keynes does — it follows that the construction of theoretical models where economic agents *believe* that 'the existing state of affairs will continue indefinitely, except in so far as they have specific reasons to expect a change' is, from the viewpoint of mainstream economists, flawed. Second, the accusation of 'nihilism' is related to the fact that the possibility of generating clear testable predictions in Keynes's theory is, according to some mainstream economists, precluded by the fact that economic agents' expectations are exogenous and may change capriciously. However, as we will argue below, the latter also stems from the fact that, unlike in neoclassical economics, in Keynes's macro-theory the theoretician does not 'impose' her view of P-S upon the agents. Lastly, the accusation of positing theoretical models where the behaviour of economic agents is 'irrational' or *ad hoc* is also a direct consequence of the fact that, in Keynes's macro-theory, agents exhibit 'ends-rationality' and 'means-rationality' but *not* 'beliefs-rationality'. In other words, Keynesian economic agents are not optimizers and, hence, from the standpoint of neoclassical theory, this is tantamount to 'irrational' behaviour (Becker, 1962). Nevertheless, we will argue that the failure to optimize by Keynesian economic agents ultimately stems from the fact that, whereas neoclassical theory presumes that there exists an 'inductive logic', Keynes's macro-theory presumes the opposite.

Now, we have argued recently in Ayala & Palacio-Vera (2015) that the adoption of the 'subjectivist' version of Popper's Rationality Principle (*RPs*) implies that the theoretician reconstructs P-S 'as she believes that agents believe it is'. We will argue below that, if Keynesian macro-theory is interpreted as an instance of *RPs*, the above-mentioned criticisms are unwarranted. First, even if the theoretician does *not* believe that 'the existing state of affairs will continue indefinitely', she may nevertheless assume that economic agents believe so, or else, that they believe this is the best

assumption they can make owing to the presence of uncertainty. Indeed, people make decisions every day in spite of the fact that, in many circumstances, they are uncertain of their future consequences. It follows that the interpretation of Keynesian macro-theory we propound based upon its implicit adoption of *RPs* implies, arguably, that there is no inherent contradiction in assuming that economic agents believe that 'the existing state of affairs will continue indefinitely, except in so far as they have specific reasons for expecting a change' even though the theoretician does not believe so. Second, if it is assumed that economic agents believe for practical purposes that the 'future will resemble the past', then Keynesian theory cannot be accused of portraying individual behaviour as 'irrational' since the former is *coherent* with agents' belief in the presence of a high degree of stability in economic affairs. Last, Keynesian macro-theory cannot be accused of 'nihilism' either since the assumption that economic agents believe that 'the existing state of affairs will continue indefinitely, except in so far as they have specific reasons to expect a change' enables the theoretician to construct macro-models that yield testable *predictions* (as opposed to forecasts) by which we mean the 'logical implications' of the theory.

The content of the essay is as follows. The following section presents Keynes's approach to probability and expectations as presented in his *Treatise on Probability*. In section 3, we expound Ramsey's critique on the notion of probability Keynes advocates in the *Treatise* as well as other relevant aspects of Ramsey's thought as presented in his essay *Truth & Probability*. In section 4, we present the approach to expectations Keynes adopts in his later economic writings in the wake of his capitulation to Ramsey's views as well as his views on the nature of economics and its object of study. We propose the notion of HC to illustrate the thesis that the theory of knowledge and learning implicit in Keynes's macro-theory is compatible with PTKL. In section 5, we argue that some of the criticisms of Keynesian macro-theory by mainstream economists can be rationalized as stemming from the fact that the latter implicitly adopt the 'objectivist' version of *RP* whereas, according to us, Keynesian macro-theory is an instance of the 'subjectivist' version of *RP*. Further, we argue that, if reinterpreted in this fashion, Keynesian theory can answer most, if not all, the charges levelled at it. Finally, section 6 summarizes and concludes.

2. The Treatise on Probability

This section is devoted mainly to presenting Keynes's philosophical work in his *Treatise on Probability* (Keynes, 1920). As we will see, this work stems partly from the attempt by Keynes to find a solution to the 'problem of induction' as posited by Hume two hundred years earlier and, partly, from an attempt to answer Cambridge philosopher G. E. Moore. There is an ongoing debate about the relevance of Keynes's philosophical work for understanding his later economic writings. However, although we will refer in passing to this debate at different points in our discussion, one reason for reviewing this episode of Keynes's intellectual journey is that there are three key elements of Keynes's later economic writings which are already present in his *Treatise on Probability*: (i) the possibility that some probabilities are unmeasurable, (ii) the notion of the 'weight of the argument', and (iii) the rejection of the frequency approach to probability in the social sciences. Another reason for reviewing the *Treatise* is that, in the aftermath of Keynes's capitulation to Ramsey's (successful) criticism of the notion of objective probability relations, Keynes implicitly adopted in his later economic writings a theory of human nature similar to Hume's. In particular, Hume's conclusion that human behaviour is not 'rational' insofar as it is grounded on 'custom and habit' could be applied, in principle, to Keynes's theory of human behaviour as based on conventional knowledge. However, we will argue in subsequent sections that this is not the case since Keynes's later macro-theory can be rationalized in the light of both PTKL and RPs.

2.1. The ethical roots of Keynes's *Treatise on Probability*

Bateman (1988) argues that Keynes's *Treatise on Probability* is, at least partly, an answer to Moore's *Principia Ethica*. Moore (1993[1903]) believed that our actions should be evaluated solely in terms of their consequences but, unlike utilitarians, he thought that the value placed on those consequences was an *objectively* identifiable amount of good.² Given the objective quality 'good', Moore's fundamental questions were: (i) to make correct ethical judgements of what things possessed the quality 'good', and (ii) to identify the actions that caused 'good' things to come about. He concluded that we must follow certain rules which, according to him, represent the accumulated knowledge in our society that, in most cases, the rule results in the highest expected good. In other words, Moore's conclusion was that the 'best' action was the one with the most likely good. In turn, this implied that we should consider *both* the goodness of an action's consequences and the relative frequency with which they occur.

As Bateman (1988, p. 1100) notes, Moore 'accepted that most of the rules adhered to in society did, in fact, *generally* cause the greatest good'. By contrast, Keynes and his friends were radically opposed to obeying rules in spite of the fact that they became members with Moore in the secret Cambridge society known as the *Apostles*. Many years later, in a piece titled 'My Early Beliefs' published in 1938, Keynes (1973a, p. 445) admitted that the large part played by considerations of probability in Moore's ethics was a crucial contributory factor to his decision to study probability theory in the subsequent years.

In a series of notes Keynes wrote in 1905 titled *Miscellanea Ethica* he sought to attack Moore's probabilistic argument for rules and chose to argue against Moore's use of the *frequency* theory of probability (Bateman, 1988, p. 1101). In particular, in the piece titled 'Ethics in Relation to Conduct' Keynes sought to uncover the fallacies in Moore's argument for rules. The alternative theory of probability he resorted to was one in which probability is an objective 'degree of belief' in a certain proposition rather than the relative frequency with which a certain phenomenon occurs. As Bateman (*op. cit.*, 1102) recognizes, this theory of probability was a nascent version of the theory Keynes would propound some years later in *A Treatise on Probability*. According to him, the replacement of a frequency approach to probability by the notion of 'degree of belief' meant that:

'In Keynes's theory of probability the good of each possible outcome would be multiplied by the degree of belief that one had in its occurrence, giving a product of good and degree of belief. The summation of these products would represent the expected good of an action and might be said to represent the degree of expected goodness of the action. This alternative conception freed one from Moore's "rules of Common Sense" since one was no longer obligated to act according to a frequency of [past] outcomes. Each case could now be considered on its own merits' (Bateman, 1988, p. 1102).

Bateman (*op. cit.*, p. 1103) also argues that Keynes followed Moore's method of describing the 'good' in identifying the existence of a logical relationship as the basis for one's 'degree of rational belief' in a proposition. Whereas Moore identified good as an objective concept that was indefinable in terms of anything else, Keynes (1920) also defined probability as an objective concept indefinable in terms of anything else.³ By

putting together his (objective) notion of probability as the 'degree of rational belief' and Moore's (objective) notion of good as indefinable in terms of anything else, *Keynes concluded that it was possible to make expected utility calculations solely on the basis of our (objective) knowledge of both good and probability* and, unlike Moore, without having to resort to long-run relative frequencies of outcomes (Keynes, 1920, ch. 26). In other words, Keynes adopted Moore's notion of good and built on it by developing a logical theory of probability. He then replaced the frequency theory of probability upon which Moore's ethics was based by his own notion of probability as 'degree of rational belief'. The end result was an ethics that differed markedly from Moore's in the sense that following rules was not justified. Lastly, as Bateman (1988, p. 1104) notes, Moore came to accept in *Ethics* (Moore, 1912) Keynes's definition of probability as the 'degree of belief' in a proposition.

2.2. Hume, Keynes & induction

Some scholars have suggested that Keynes wrote the *Treatise on Probability* to answer Hume (Fitzgibbon, 1988, p. 10; Davis, 1994, p. 142; Klant, 1985).⁴ For instance, Klant (1985) argues that Keynes's main intention in writing the *Treatise* was to solve the 'problem of induction' that had been set out by Hume (2006[1748]). According to Keynes (1920), Hume's case against induction had not yet been answered: 'Hitherto Hume has been master' (Keynes, 1920, pp. 303-04). He thought that the logical system of Russell (and Whitehead) was constrained to exploring logical deductions and, hence, could not deal with the *non-deductive* method of reasoning that most people employ. As Andrews (1999, p. 2) remarks, 'Keynes wished to construct an analytical structure for probable reasoning that would, at least to a certain extent, parallel that which Russell and Whitehead had produced for deductive reasoning'. This way, he would answer to Hume who concluded more than two hundred years before that: (i) it is not possible to ground probabilistic judgements in reason, and (ii) that the former are held only on the basis of repetition or 'custom and habit'. Hume (2006[1748]) believed that *a priori* theorizing cannot tell us much about empirical relationships of cause and effect and that all knowledge we have of them comes from experience. Furthermore, he thought we do not experience causality relationships 'directly' but rather *infer* them from the observation that certain phenomena concur. Yet, he argued that in order to infer from a constant conjunction of phenomena that a causality relation actually exists requires to make the additional (and unwarranted)

assumption that the 'future must conform to the past' (Hume, 1995[1748], p. 652). As we know, Hume argued that this assumption was *unprovable* in the sense that it was not liable to demonstrative proof. Nevertheless, he concluded that despite the impossibility of proving it, people constantly make decisions that are based on it due to the fact that they have no better alternative if they seek to pursue their interests (Hume, 2006[1748], pp. 269-70). Hence, his profound scepticism about human rationality.

Keynes apparently found Hume's argument against induction powerful although inconclusive: 'Hume showed, not that inductive methods were false, but that their validity had never been established and that their possible lines of proof seemed equally unpromising' (Keynes, 1920, p. 313). Unlike Hume, Keynes believed that there was a more robust foundation for probabilistic knowledge than 'custom and habit' and thought he had found it in the notion of probability as a logical relationship between two sets of propositions: premises and conclusions. In any case, his ulterior abandonment of the notion of probability that he had advocated in the *Treatise* led him to embrace a view of human rationality that was similar to Hume's.

Next, Keynes's *Treatise on Probability* addresses the question how knowledge is acquired. According to Keynes (*op. cit.*, pp. 3-4), knowledge is of two different forms: direct and indirect. First, direct knowledge is knowledge about (empirical) propositions concerning objects of direct acquaintance and where the propositions can derive from personal experience, sensorial perception or understanding. In any case, Keynes argues that the 'true' objects of knowledge and belief — in opposition to the objects of direct acquaintance — are not sensations, meanings, and perceptions but *propositions*. Keynes (*op. cit.*) denotes them as 'primary propositions'. As he explains, the latter consist of propositions that capture our knowledge of the world and a further proposition that expresses a conjecture about the real world. For instance, given our current knowledge of the workings of the Eurozone and Greek history and politics, we think that it cannot be ruled out that Greece will eventually defect from the Eurozone. By contrast, indirect knowledge consists of 'secondary propositions' such as probability relations which are the result of arguments concerning 'primary propositions' and which may result either from the application of 'formal' logic (i.e., demonstrative knowledge like mathematics) or 'human' logic (i.e., non-demonstrative knowledge).⁵ In our example, the 'secondary proposition' consists of the probability that Greece will eventually leave the Eurozone. According to Keynes, theory construction consists of generating indirect knowledge in the form of 'secondary propositions'. In any case, he argues that in all knowledge there

is always some direct element so that 'logic can never be made purely mechanical' (Keynes, *op. cit.*, pp. 14-15) and it is on the basis of it that we seek to justify many further propositions or:

'That part of our knowledge which we obtain directly, supplies the premises of that part which we obtain by argument. From these premises we seek to justify some degree of rational belief about all sorts of conclusions' (*op. cit.*, p. 121).

Next, by the time Keynes wrote the *Treatise* he was mainly concerned to provide a logical foundation for induction, such as Whitehead and Russell (1925) had done for deduction. He was a student of probability theory before he became an economist and developed his ideas on probability prior to those on uncertainty. He was concerned with probability as the foundation for rational decision making rather than with descriptive statistics or with probability as a feature of the world. According to Carvalho (1998, p. 66), his main motive in writing the *Treatise* was to explain how a certain 'degree of belief' and the subsequent choice can be shown to be a *logical* consequence of a given set of premises and, hence, not merely a matter of the believer's psychological features. Since he was reluctant to study the mechanisms through which the premises upon which decisions are based are generated, he skipped the issue *by assuming that the premises upon which the decision-making process is based were true knowledge* (*op. cit.*). By so doing, Keynes was able to focus on deriving knowledge *by argument*. Consequently, the conclusion thus obtained was 'rational' to the extent that it did not depend on individual peculiarities but rather on criteria of consistency with 'formal logic'.

Now, Keynes was aware that in many real-world circumstances neither certainty nor impossibility can be shown by 'formal logic'. In all such cases, the relation between the premises and the conclusion was only *probable*. As noted in Carvalho (1988, p. 72), probability is approached in the *Treatise* as part of a learning process, that is, the larger is the (direct) evidence that accumulates in the form of premises, the more likely the conclusions obtained by argument are. This 'cumulative' view of learning is a logical implication of the inductive theory of knowledge Keynes had adopted. Indeed, it will become clear below that the probability theory of the *Treatise* is based on an *inductive* theory of knowledge. This is evident in chapter II and Part III (Induction and Analogy) of the *Treatise*. An example of this is the following quotation from the *Treatise*:

‘The validity of the inductive method does *not* depend on the success of its predictions. Its repeated failure in the past may, of course, supply us with new evidence, the inclusion of which will modify the force of subsequent inductions. But the force of the old induction *relative to the old evidence* is untouched. The evidence with which our experience has supplied us in the past may have proved misleading, but this is entirely irrelevant to the question of what conclusion we ought reasonably to have drawn from the evidence then before us’ (Keynes, 1920, p. 221).

Further, Keynes identifies knowledge with ‘certainty’ and, crucially, he assumes that knowledge (and, hence, certainty) is *obtainable*:

‘All knowledge, that is to say, which is obtained in a manner strictly direct by contemplation of the objects of acquaintance and without any admixture whatever of argument and the contemplation of the logical bearing of any other knowledge on this, corresponds to *certain* rational belief and not to a merely probable degree of rational belief’ (*op. cit.*, p. 16).

Notwithstanding it, as David Hume showed long ago, direct knowledge cannot generate a set of ‘true’ premises that allow us to maintain a conclusion with certainty because our knowledge is always finite whereas the evidence is potentially infinite and, hence, never conclusive. Unfortunately, Keynes did not provide any further discussion about the epistemological status of the premises in the *Treatise* and the development of his ideas on decision-making tended to shift from probability to uncertainty.⁶

Next, Bateman (1991, p. 104) has argued that like Moore and Russell in the first decade of the 20th century Keynes ‘was committed to a very strict type of ontological realism; he believed that things and concepts have a real existence’. In this respect, he believed that there are propositions which describe the (non-physical) world and that the process of acquiring knowledge about it consisted of knowing these propositions. In turn, acquisition of knowledge was based on an inductive mechanism. A large part of the *Treatise* was thus devoted to the examination of the probabilistic nature of inductive arguments. Let us distinguish between the two types of inductive arguments Keynes identified. The first type is known as *universal induction* or arguments about invariable relations such as ‘all swans are white’ in which we seek to determine the correct ‘degree of belief’ in a given proposition that is either true or false. The other type of inductive

argument is known as *statistical induction* and deals with arguments such as 'ninety percent of swans are white'. Keynes devoted Part III ("Induction and analogy") of the *Treatise* to the analysis of universal induction and Part V ("Foundations of statistical inference") to the analysis of statistical induction.

Let us first address the case of universal induction. According to Keynes, every universal induction is made up of two elements: likeness and number. When we observe several instances of a phenomenon and make use of them to lend support for a universal induction, we rely on: (i) the fact that each instance exhibits the necessary likeness (e.g., all the observed birds are swans and they are all white), and (ii) the number of times we observe the *same* phenomenon. Keynes denoted these two elements of an inductive argument by *analogy* and *pure induction* respectively. He thought that pure induction was of very little use and that the correct way to make empirical arguments is through analogy. He then distinguished between positive and negative analogy (Keynes, 1920, p. 223). The former captures all the similar features shared by the observed instances whereas the latter refers to all their dissimilar features. According to Keynes (*op. cit.*, p. 259), it is only an *increase* in negative analogy that enhances the validity of empirical arguments. Therefore, although the elements of an inductive argument are likeness (or analogy) and number, the latter is relevant only to the extent that it provides evidence about negative analogy.

As Bateman (1990, p. 366) notes, Keynes's justification for inductive arguments depended crucially on two explicit assumptions: (i) the 'law of uniformity of nature', and (ii) the existence of 'limited independent variety' (Keynes, 1920, ch. 22). Firstly, the validity of inductive arguments depended on the ability to ignore *differences in time and space* among all observed instances. In other words, one needed to assume both that past observations would be valid in the future and that the generalizations made held regardless of our geographical location. Secondly, Keynes also believed that a positive *a priori* probability — which was a necessary condition for deriving the probability of a generalization after n observations within his framework — could be assigned to a 'primary' proposition provided it could be assumed that there were a *finite* range of features which were relevant to the generalization. As Bateman (1990, p. 366) observes, although Keynes felt that these assumptions were plausible, he could not prove them and consequently could not offer a justification for induction.

Notwithstanding the previous conclusion, it has been suggested that Keynes's discussion of statistical inductions served him to make the point that probabilities are

not tantamount to relative frequencies. As Bateman (1990, p. 367) recognizes, Keynes believed that 'the probability of observing a white swan was not necessarily the same as the percentage of swans which were known to be white'. More specifically, he believed that what one was trying to figure out was not what proportion of observed swans were white but what 'degree of belief' it was reasonable to hold in different statements about that proportion. He insisted that we should not confuse the past occurrence of a relative frequency with its future occurrence and that probabilities were 'degrees of belief' and not relative frequencies. In chapter 28 of the *Treatise* titled 'The law of great numbers' he traces the origin of the argument that after a large enough number of observations a stable pattern of frequencies will emerge and points to French mathematician Quetelet for the formulation of this law. Keynes concludes that 'observation shows that some statistical frequencies are, within narrower or wider limits, stable. But stable frequencies are not very common, and cannot be assumed lightly' (Keynes, 1920, p. 368). As we will see below, this rejection of a frequency interpretation of probability in the *Treatise* is a direct antecedent of his later claim, in the context of his criticism of Tinbergen's pioneering work on the application of statistical methods to economics, that 'economic data are not homogeneous through time'. Finally, an analysis of the foundations of the 'law of great numbers' is in chapters 29-31 of the *Treatise* where Keynes argues that it is based on *unwarranted* assumptions about the distribution of the variables. The main source of Keynes's disagreement with advocates of the 'law of great numbers' was that their method was *not* inductive:

'[Keynes] felt that instead of examining many instances and trying to *induce a pattern* from these, they had relied on undifferentiated observations and *assumptions about a pattern*. His complaint was not that they had used formulas or theorems but that (in his perception) these were used to circumvent the process of induction; instead of explaining how one could induce the likelihood of a frequency, these methods assumed the problem away' (Bateman, 1990, p. 368).

Keynes's alternative to the (relative) frequency theory of probability consisted of an *extension* of the elements of a universal induction to the case of statistical induction. In particular, he argued that in universal induction one observed a series of instances in varying circumstances and used this series to establish that a certain invariable relation (i.e., empirical regularity) held in many different circumstances. By contrast, in the case

of statistical induction a series only represented one instance since one needed to count the relative frequency with which different characteristics appeared in the series. Thus, as Bateman (1990, p. 369) explains ‘in this case a “series of series” constituted the same thing as a series of observations in universal induction’. In particular, one would need to observe the relative frequency of occurrence of a certain feature (e.g., white swans) in many different series and increased the probability of the frequency’s future occurrence (e.g., that ten percent of all swans are white) by increasing the negative analogy (i.e., by observing that frequency in the widest array of circumstances) between series. In sum, Keynes’s argument against early proponents of the frequency theory of probability was that their methods amounted to *pure* induction or *number* insofar as they did not take (negative) *analogy* into consideration (Keynes, 1920, pp. 445-46).

2.3. Probability

Following Gillies (2000), interpretations of probability can be divided into (i) epistemological, and (ii) objective. According to the former interpretation, probability is concerned with the knowledge or belief of human beings. In other words, probability measures ‘degree of belief’, ‘degree of rational belief’, etc. However, ‘epistemological’ interpretations of probability can themselves be either objective or subjective. Keynes, Ramsey, De Finetti, and Savage all adopted ‘epistemological’ approaches to probability theory. Notwithstanding it, while Keynes initially adopted (in his *Treatise*) an objective ‘epistemological’ interpretation, Ramsey, De Finetti and, Savage adopted a subjective ‘epistemological’ interpretation of probability.⁷ By contrast, according to ‘objective’ interpretations of probability, the latter is a feature of the physical world which has nothing to do with knowledge or belief. In other words, human beings may know this probability or they may not but the probability is said to *exist* independently of whether it is known. Two well-known examples of ‘objective’ interpretations of probability are: (i) von Mises’s (1928) frequency theory of probability, and (ii) Popper’s propensity interpretation of probability⁸ (Popper, 1959). The frequency theory of probability has been adopted by most mathematicians and consists in the description of the forms and properties of the randomness exhibited by the object of knowledge. An implication of it is that, if the stochastic processes are stable (or ergodic) then repeated observation of the object of knowledge allows us to acquire knowledge about its underlying structure. It is this feature of stochastic processes that Keynes apparently rejected and which made him sceptical of the application of statistical methods in economics. Likewise, his scepticism

about the possibility of economic data being 'homogeneous through time' explains, to a large extent, his view of theoretical models as instruments for 'explaining' economic phenomena rather than for generating 'forecasts'.

The *Treatise on Probability* (Keynes, (1920) is, along with the work of Jeffreys (1939) and Carnap (1950), part of the 'logical' tradition in the theory of probability. In this tradition, probability is conceived as a *logical* relation between a conclusion and certain evidence. In Keynes's view, logic had always considered such relationships but it had only dealt with the cases in which one's information implied that a proposition was true or false. His project in the *Treatise* was to extend logic to those cases — the most common in science and life — where we are uncertain about a proposition given the evidence available. This feature is stressed in Runde (1990, p. 277) who explains that 'unlike the frequency theory of probability in which probability is interpreted as a property of the physical world, Keynes treats probability as a property of the way individuals think about the world'. In the same vein, Carvalho (1988, p. 71) points out that in the frequency theory of probability 'the accumulation of knowledge does not change probabilities, because randomness is a feature of the object of knowledge, not of knowledge itself'. By contrast, Keynes's notion of probability implies that a probability proposition may *change* when the evidence upon which reasoning is based changes.

Next, in the *Treatise* Keynes draws a sharp distinction between the certainty of the conclusions of demonstrative logic and the inconclusiveness of non-demonstrative logic on which scientific (and non-scientific) arguments are typically based. As we have explained above, he defends the *real* existence of a logical relation between two or more propositions in those cases where it is impossible to construct a demonstrative argument from one to the other. He denotes this logical relation as the *probability relation* or *argument*. Therefore, a conclusion a is related to a set of premises h by virtue of a probability relation. This is written as $a/h=p$, where p is the 'degree of rational belief' that the probability relation between a and h justifies. In turn, Keynes (1920) denotes this probability relation as a 'secondary proposition' which, as we explained above, constitutes a logical statement about the 'primary proposition' a . The probability of a conclusion a is always relative to a set of evidence h . If the relation between a and h were tautologous or true then $p=1$ whereas if it were contradictory or false then $p=0$. If the evidence did not guarantee the truth or falsehood of the proposition, there existed a 'degree of rational belief' between 0 and 1 in the propositions' truth. The discovery of new evidence hI will not affect the validity of the probability relation between a and h ,

but will yield a new one $a/hh1$. This way, Keynes extended Russell's logic of certainty (true and false propositions) to uncertainty (i.e., to more or less probable propositions).

Now, Keynes's approach to probability might be interpreted as subjective since the amount of information and reasoning power may vary across individuals. However, Keynes stresses the objective component which he denotes as the 'degree of belief' it is *rational* to hold in a certain hypothesis given the evidence available (Keynes, 1920, p. 4). As Cottrell (1993, p. 27) notes, there is a *Platonic* element in Keynes's interpretation of probability in the sense that probability relations exist in a certain logical space and are assumed to be perceived by individuals via intuition. This implies that, if opinions that are based *on the same evidence* differ, it follows that somebody's perception must be wrong. In other words, Keynes's approach to probability implies that probabilities are *unique* and have the same value for all the individuals who happen to possess the *same* information. By contrast, in subjective theories of probability the probabilities will take whatever value is assigned by the individual using them. This means, for instance, that in the subjective theory of probability originally propounded by Ramsey (1926) and De Finetti (1937), any two individuals with the same information can assign *different* numerical values to the probability of a certain proposition whereas, in Keynes's theory of probability, two individuals with the same information will assign the *same* value to the probability of a proposition. Crucially, the objectivity of probabilities in Keynes's theory is not based on inter-subjective agreement among individuals — as in the inter-subjective approach propounded in Gillies (2000) — but on the real existence of logical Platonic-like probability relations. As Lawson (1988, p. 44) concludes, the difference between Keynes' approach to probability and the approach adopted by Ramsey (1926), De Finetti (1937) and, later on, Savage (1951) is that 'although both approaches accept that probability exists only on the level of knowledge or opinion Keynes believes that probability is objectively determined'.

2.4. Rationality

Both Bateman (1987, pp. 101-102) and Andrews (1999, p. 6) make the point that Keynes's argument for the objectivity of probabilities is related to the inductive theory of knowledge expounded in Parts III and V of the *Treatise*. According to Keynes, there is an essential connection between the inductive methods and the notion of probability he presents in the *Treatise*. In particular, he argues that an induction is just a *particular* application of his theory:

‘An inductive relation affirms, not that a certain matter of fact is so, but that relative to certain evidence, there is a probability in its favour’ (Keynes, 1920, p. 254).

That is, Keynes believed that probability is a ‘logical’ relationship between two propositions: (direct) evidence and conclusion. Further, *he also believed that decisions are based on probabilistic judgements. To the extent that human behaviour is grounded upon objective probability relations, the former is ‘rational’*. Thus, unlike Hume, who believed that human behaviour was grounded on ‘custom and habit’, he concluded that rational probability is the ‘guide of life’ (*op. cit.*, p. 369). As Bateman (1991, p. 105) writes, ‘the end result of all this was a conception of probability which relied on intuition as the basis of rational choice’. Specifically, individuals were *assumed* to know the ‘correct’ probabilities of the various outcomes — given the evidence available — and to weight the value of each possible outcome by its probability. In turn, Keynes’s argument that probabilities are ‘rational’ is based on the idea that they had been *inferred* correctly from the available information through inductive methods (Bateman, 1987). Therefore, the whole process was *rational*. Be that as it may, we will see below that his view of rationality underwent a dramatic change in the aftermath of his acceptance of Ramsey’s criticism of logical probability relations (Ramsey, 1926) and those changes pushed him back towards the views on human nature held by Hume.

In terms of the conceptual framework we used in the previous chapter, we may assert that the logical probability relations Keynes devised in the *Treatise* satisfy means-rationality and beliefs-rationality (Hamlin, 1986).⁹ Yet, this is not to deny the possibility that realized outcomes may differ from *ex-ante* expectations. To be sure, an individual who makes decisions according to Platonic-like probability relations may well obtain a result which differs markedly from the expectation she held with a certain ‘degree of rational belief’ yet such unexpected outcome cannot be said to be a mistake but rather it is a mere consequence of the fact that, in Keynes’s *Treatise*, knowledge is probabilistic and, therefore, liable to error. Further, the theory Keynes developed in the *Treatise* can be interpreted as being both a positive and a normative theory, that is to say, as being a description of human behaviour as well as a ‘guide’ to it. To be sure, Keynes’s assertion in the *Treatise* that human decisions are based upon probability judgements and that the latter are ‘rational’ insofar as they are built upon ‘correct’ inductive inferences makes it unequivocal that he conceived of probabilistic judgements

as descriptions of individual behaviour. By the same token, if human behaviour is 'rational' it then follows that it is 'desirable' that the former be based upon logical probability relations.

Next, O'Donnell (1990, p. 257) argues that part of the deeper analytical structure of the *Treatise* is constituted by two distinct domains of analysis. The first domain is the *determinate* domain, the ruler of which is *strong rationality*. As in Simon's well-known notion of 'substantive rationality' (Simon, 1976), within the domain of strong rationality determinate answers are available to the questions posed and it is assumed that reason is capable of providing the answers. Our previous discussion about Keynes's notion of probability as 'degree of rational belief' in the *Treatise* and its accompanying notions of 'primary' and 'secondary' propositions do correspond to O'Donnell's notion of *strong rationality*. The other domain identified in O'Donnell (*op. cit.*) is the *indeterminate* one and is associated to the notion of *weak rationality*. As O'Donnell (*op. cit.*) argues, in the *indeterminate* domain 'probabilities are unknown for want of reasoning power; it is theoretically impossible to compare probabilities; weights are also non-comparable; and agents are thus unable to combine probabilities and values where either or both are non-numerical'. According to O'Donnell (1990, p. 258), the theory of the *Treatise* embraces both domains and, although the development of the determinate domain was Keynes's major concern in and prior to the *Treatise*, the existence of an indeterminate domain was recognised albeit relegated to a subordinate position. Nevertheless, he adds that it is certainly the indeterminate domain that Keynes sought to develop in his later economic writings.¹⁰ In turn, this serves him to insist on the 'continuity' thesis, that is, the claim that there is a basic continuity in Keynes's conceptual framework between the *Treatise on Probability* and the *General Theory*) against advocates of the 'non-continuity' thesis, i.e., that there is a substantial change or a 'break-up' in Keynes's thought between the *Treatise* and his later economic writings (Andrews, 1999; Bateman, 1987, 1990, 1991; Davis, 1994).¹¹

Be that as it may, O'Donnell (1990) insists that the absence of strong rationality in Keynes's conceptual framework in his later economic writings is not tantamount to 'irrationality'. Rather, he contends that individuals will adapt to the new circumstances and develop strategies to 'get by'. He groups such strategies under the heading of *weak rationality*; in the indeterminate domain rational individuals know that weakly rational procedures result from the lack of robust foundations in certain or probable knowledge and, hence, they have low and easily shaken, degrees of confidence in such procedures.

Further, he argues that Keynes observes that despite being uncertain of the future people know certain facts of the existing situation as well as ways of ‘getting by’ in the absence of knowledge of the relevant (numerical) probabilities. Such ways of ‘getting by’ bear a resemblance to Simon’s notion of ‘procedural’ rationality (Simon, 1976). For instance, in the context of investment decisions, Keynes argues that investors often ‘endeavour to fall back on the judgement of the rest of the world which is perhaps better informed’ (Keynes, 1937, p. 214). However, this interpretation of Keynes’s notion of rationality as implying two domains has been criticized in Bateman (1991). He refers to O’Donnell’s (1990) notion of *weak rationality* as follows:

‘Here all of Keynes’s careful argument about probability as the “guide of life” comes tumbling down. With one deft stroke, the people who follow social conventions and conventional rules of behaviour are out on a par with those who have the full ability to recognise (and act upon) Platonic probabilities’ (Bateman, 1991, pp. 108-9).

According to Bateman (*op. cit.*), O’Donnell’s interpretation of Keynes’s *Treatise* has two problems: (i) that Keynes never mentioned a second theory of rationality in his *Treatise*, and (ii) that his many references to ‘irrational’ behaviour in his later economic writings suggests that, far from having a *dualistic* theory of human rationality, he made ‘irrationality’ the basis of his macroeconomics. Although we do not subscribe the latter appraisal of the theory of human behaviour underlying Keynes’s *General Theory*, we share Bateman’s argument that presenting Keynes’s framework in the *Treatise* as made up of two different domains of analysis is inappropriate in that it places more emphasis on the existence of continuity in Keynes’s thought than it seems to be justified by the textual evidence. Having said that, we believe it is in the following ideas that appear in the *Treatise* where there is a clear connection between his previous work on probability theory and his later economic writings: (i) the idea that some probabilities may not be measurable, (ii) the ‘weight of an argument’, and (iii) the illegitimacy of the frequency approach to probability in economics.¹² We address the first two issues in what follows.

2.4.1. Uncertainty

Keynes does not explicitly define uncertainty in the *Treatise*. Uncertainty seems to be related to the absence of certainty but it is a particular lack of certainty. To be sure, Lawson (1987, p. 953) argues that in the *Treatise* Keynes identifies three different types

of probability relations: (i) where a probability relation is numerically indeterminate and, possibly, not comparable to other probability relations, (ii) where probabilities are numerically determinate and take on values between unity and zero, and (iii) where probabilities take the value of either unity or zero. According to Lawson (1985, p. 911), Keynes associates the first type to a situation of ‘uncertainty’ and the third type to a situation of ‘certainty’. Next, focusing on the first type of probability relation, Keynes (1920) identifies two scenarios in which ‘direct’ knowledge and, hence, certainty of a secondary proposition or probability relation concerning a given primary proposition a based on a certain type of evidence h is absent. The first scenario is when the secondary proposition $a/h=p$ is *unknown* because the weakness of our reasoning and computing power prevents us from knowing what the probability relation is in spite of the (direct) evidence justifying a certain degree of knowledge (*op. cit.*, p. 34). Let us refer to the type of uncertainty that stems from this first scenario as *epistemological*. The second scenario Keynes identifies is when probability relations *can be said not to exist or when they are numerically immeasurable or indeterminate* because there is no basis possible, given the existing evidence, for determining the numerical probability of the secondary proposition. Let us denote the resulting type of uncertainty as *ontological*.

Now, Lawson (1985, p. 914) insists that it is the second scenario where ‘direct’ knowledge of a secondary proposition is absent because there is no basis upon which to generate any (numerical) probability that corresponds to a situation of ‘uncertainty’ in Keynes. In other words, according to Lawson, ‘uncertainty’ is not a situation in which the probability relation is known and where the primary proposition a relative to the evidence h yields a numerical probability that is *less* than unity. Neither is it a situation in which an existing probability relation cannot be grasped due to our limited cognitive powers. Rather, he insists that ‘uncertainty’ in the *Treatise* arises when the probability relation that concerns a primary proposition a is *numerically indeterminate*. In short, Keynes’s notion of ‘uncertainty’ is *ontological* albeit, in some circumstances, the source of uncertainty may well be epistemological. According to Lawson, this interpretation of Keynes’s notion of uncertainty in the *Treatise* is consistent with Keynes’s use of the same term in the *General Theory* and in his 1937 *Quarterly Journal of Economics* paper where he says that ‘very uncertain’ is not the same as ‘very improbable’ (Keynes, 1937, pp. 213-14).

2.4.2. The ‘weight of an argument’

Let us address Keynes’ notion of the ‘weight of an argument’. Runde (1990, p. 133) denotes Keynes’s theory of expectations formation as a ‘two-tier theory of belief’ whereby probability is at a first level whereas weight is at the second level. The former represents a measure of our ‘degree of belief’ in a hypothesis *relative* to some set of evidence whereas the latter constitutes a measure of the ‘degree of completeness’ of the evidence on which that belief is based.¹³ According to Runde (1990), Keynes alludes to the notion of weight in the *Treatise on Probability* in, three different ways.¹⁴ According to the first conception of weight (weight1), ‘one argument has more weight than another if it is based on a greater amount of relevant evidence’ (Keynes, 1920, p. 77). The second conception of weight that Runde identifies (weight2) appears in Chapter 6 of the *Treatise* where weight is defined as the ‘balance of the absolute amounts of relevant knowledge and relevant ignorance on which a probability is based’ (*op. cit.*, p. 280). To be sure, if we denote relevant knowledge and relevant ignorance by Kr and Ir respectively and weight by V , then the latter may be expressed as:

$$V(a/h) = Kr/Ir \quad (1)$$

The third notion of ‘weight’ appears in Chapter 26 of the *Treatise* where Keynes makes it very clear that ‘the probability of a hypothesis is only one of the things to be determined and taken account of before acting on it’ (Keynes, 1920, p. 307). It is clear then that, as long as probabilities are used as a guide to action, the other element when making decisions is weight. The third notion of weight (weight3) identified by Runde is the ‘degree of completeness of information on which a probability is based’ (*op. cit.*, p. 313). As Runde (*op. cit.*) remarks, if knowledge, information, and evidence are taken as being synonymous terms, as Keynes apparently does, then the ‘degree of completeness’ of the information on which a probability is based might be expressed as:

$$V(a/h) = Kr / (Kr + Ir) \quad (2)$$

From expressions (1) and (2) we have that, as the amount of (absolute) relevant knowledge increases, the probability of proposition a may either rise or fall, depending on whether the new evidence is favourable or unfavourable.¹⁵ Thus, provided that Ir does not increase by more than Kr , the weight of the new probability will be *higher* than it was before. Yet, and following this interpretation, *the discovery of new evidence may*

lead to a decrease in weight. This will be the case if I_r increases by more than K_r . Runde (*op. cit.*, p. 283) admits that this possibility is not explicitly contemplated in the *Treatise* and it may contradict some of Keynes's statements. Notwithstanding it, he provides a number of examples taken from the *Treatise* itself which seem to imply the consequence that, if new evidence is discovered so that our (subjective) perception of ignorance increases (i.e., the degree of completeness of the information decreases) either because more options have now become available or because a larger array of possibilities can now be considered, then weight may *decrease* even if our (absolute) knowledge increases. In other words, according to Keynes, weight measures the 'well groundedness' of the argument and, hence, the confidence we place on it.¹⁶ Low weight means weaker foundations for decision making and low degrees of confidence whereas high weight implies strong foundations and higher degrees of confidence, even though the probabilities involved in both scenarios may be perfectly correct.

Now, whereas the first notion of weight we have identified above is objective, expressions (1) and (2) above corresponding respectively to the second and third notion of weight identified in Runde (*op. cit.*) are clearly subjective. In the case of the second version presented above, the 'balance of the absolute amounts of relevant knowledge and relevant ignorance on which a probability is based' (*op. cit.*, p. 280) can only be a subjective perception because the absolute amount of factual evidence that is potentially available is *infinite* and, hence, no observer can 'objectively' know what the balance of relevant knowledge and ignorance is.¹⁷ Likewise, in the third notion of weight identified in Runde the 'degree of completeness of information on which a probability is based' can only be a subjective perception for the same reason that the amount of information is infinite and, hence, there is no way to know what the *actual* 'degree of completeness' of the information we possess is. In other words, there is no way to know *how* ignorant we are about something we ignore. This explains why the notion of weight appears to be confusing for Keynes himself as Cottrell (1993, p. 36) notes.¹⁸ Further, this suggests that the 'two-tier theory of belief' that Runde (*op. cit.*) refers to does not only comprise probability or 'degree of rational belief' and weight but really comprises an apparently *objective* notion of probability coupled to a *subjective* notion of 'weight'. We believe it is for this reason that Keynes easily connected the notion of 'weight' of the *Treatise* to the twin notions of 'confidence' and 'liquidity preference' in the *General Theory*.¹⁹ In particular, the link is facilitated by the fact that two of the three versions of the notion of 'weight' displayed in the *Treatise* are subjective perceptions. The subjective nature of

`weight' also goes some way, according to us, towards explaining Keynes's capitulation to Ramsey's critique (Ramsey, 1978[1931]) when the latter argues that Keynes's logical probability relations do not exist and that probability is *subjective*.

2.5. Some final remarks on the *Treatise on Probability*

We have shown that Keynes's *Treatise on Probability* constitutes, at least partly, an answer to Hume by providing both an objective epistemological theory of probability and theory of rational decision-making based on an inductive theory of knowledge. As to the former, Keynes suggests that, although we cannot acquire `certain' knowledge we can nevertheless attain probabilistic knowledge. However, if we can acquire `objective' probabilistic knowledge by relying on inductive methods, the basis for both a `rational' theory of decision-making under uncertainty and an answer to Hume have been laid out. Notably, Keynes *assumes* that individuals know *via* intuition the `correct' probabilities of all possible outcomes — given the evidence accumulated — and weight the value of each possible outcome by its `correct' probability. We have suggested above that this `embryonic' theory of decision-making under uncertainty faces (at least) two problems: (i) the objectivity or `Platonic' nature of logical probability relations and, arguably, (ii) our claim that the notion of the `weight of argument' is *subjective*. The `objectivity' of *a priori* probability relations was the focus of Ramsey's critique of Keynes's *Treatise* and will be addressed in the following section. As to our claim that the `weight of argument' is subjective, we believe that it highlights the insurmountable conceptual difficulties of constructing a theory of human behaviour under uncertainty grounded, as Schumpeter (1984) would put it, upon the `rationality of the observer'.

According to us, the main conceptual difficulty the notion of *a priori* probability relations encounters is that the absolute amount of empirical evidence economic agents may come across is potentially *infinite*. In the frequency approach to probability this is dealt with by assuming that relative frequencies converge to a certain (constant) value as the number of observations increases. However, Keynes rejected the validity of the frequency approach to probability in the social sciences. As a result of it, he had to rely on Platonic-like or *a priori* probability relations to justify their `objectivity'. Otherwise, how could he argue that such *a priori* probability relations are `objective' if the amount of evidence that is potentially available and the different types of circumstances in which such evidence can be found are potentially infinite? As we will see below, the edifice

laboriously constructed by Keynes in the *Treatise* crumbled irremediably when Ramsey criticised it. Keynes capitulated in the aftermath of it (Keynes, 1973a, pp. 338-39). The upshot of it is the apparent adoption by Keynes of a subjective epistemological theory of probability which would eventually pave the way to the final adoption of a theory of human nature similar to Hume's and an (implicit) recognition of his inability to provide a solution to Hume's 'problem of induction'.

3. Ramsey's critique of the *Treatise* and his theoretical framework

Like Keynes, Ramsey grew up in Cambridge, was a student of both Moore and Russell, an Apostle and a contributor to the *Economic Journal*. In spite of his early and unexpected death in 1930 when he was only 26, he made long-lasting contributions to probability theory, philosophy, and economics. For instance, it is widely recognized that Ramsey's critique of the *Treatise on Probability* in his 'Truth and Probability' (Ramsey, 1978[1931]) constitutes, together with De Finetti's (1937), the foundation for Savage's subjective expected utility theory (Savage, 1954), which is still the standard approach to analysing decision-making in economics.²⁰ Before we present Ramsey's critique of the *Treatise* let us note that in the foreword of the above-mentioned essay Ramsey suggests that there may be two legitimate approaches to probability:

'Probability is of fundamental importance not only in logic but also in statistical and physical sciences, and we cannot be sure beforehand that the most useful interpretation of it in logic will be appropriate in physics also. Indeed, the general difference of opinion between statisticians who for the most part adopt the frequency theory of probability and logicians who mostly reject it renders it likely that the two schools are really discussing different things, and that the word "probability" is used by logicians in one sense and by statisticians in another' (Ramsey, 1978 [1931], p. 59).

Thus, as with Keynes's (implicit) acceptance some years after the publication of the *Treatise* of the legitimacy of the frequency theory of probability in the context of the natural sciences, Ramsey suggests that, at least in physics, the requirements for the use of the frequency theory of probability are fulfilled. Therefore, in both cases (Keynes and Ramsey) there is a clear *duality* in the theory of probability. We will return to this issue below when we address Keynes's ideas on the methodology of economics.

3.1. Ramsey's critique

We now address the essence of Ramsey's critique of the *Treatise on Probability*. As we will see below, this critique had a dramatic impact on the views Keynes adopted on probability theory and the methodology of economics at least from 1932 onwards and, hence, it is an indispensable ingredient in any attempt to understand Keynes's later economic writings. In a much-quoted paragraph, Ramsey writes:

'But let us now turn to a more fundamental criticism of Mr. Keynes' views, which is the obvious one that there really do not seem to be any such things as the probability relations he describes. He supposes that, at any rate in certain cases, they can be perceived; but speaking for myself I feel confident that this is not true. I do not perceive them, and if I am to be persuaded that they exist it must be by argument; moreover I shrewdly suspect that others do not perceive them either, because they are able to come to so little agreement as to which of them relates any two given propositions' (Ramsey, 1978[1931], p. 63).

In other words, Ramsey denies that there are 'objective' logical relationships to which our 'degrees of belief' refer and insists that we simply have *subjective* 'degrees of belief' in different propositions. As Bateman (1987, p. 106) explains, Ramsey's critique implies that, if two individuals possess exactly the same information but they exhibit different 'degrees of belief' in a certain proposition, this does not imply — unlike in Keynes's *a priori* probability relations — that one of them is necessarily 'irrational' or wrong. Rather, the dissimilarity in their evaluations implies that these two individuals have made assessments of the likelihood of different possible outcomes that reflect their own *subjective* 'degrees of belief'. Ramsey coined the term 'human logic' to denote the subjective nature of the assessments people make and to emphasize the absence of an *a priori* probability relation. The obituary containing Keynes's answer to Ramsey was published in the *Economic Journal* in 1931, a year after Ramsey died, and leaves little doubt about his capitulation:

'Ramsey argues, as against the view which I had put forward, that probability is concerned not with objective relations between propositions but (in some sense) with degrees of belief, and he succeeds in showing that the calculus of probabilities simply amounts to a set of rules for ensuring that the system of degrees of belief which we hold

shall be a *consistent* system. Thus the calculus of probabilities belongs to formal logic. But the basis of our degrees of belief — or the *a priori* probabilities, as they used to be called — is part of our human outfit, perhaps given us merely by natural selection, analogous to our perceptions and our memories rather than to formal logic. So far I yield to Ramsey — I think he is right' (Keynes, 1973*a*, pp. 338-39).

Therefore, while Keynes had advocated an objective epistemological theory of probability in the *Treatise*, he was now willing to accept a subjective epistemological theory of probability. Furthermore, Keynes was also willing to accept that the role that Ramsey assigned to the calculus of probabilities was to ensure the *consistency* of these subjective 'degrees of belief' (Bateman, 1987). What has gone largely unnoticed in the academic literature, however, is that when referring to the source of subjective 'degrees of belief', Keynes hints that they may have been 'given us merely by natural selection, analogous to our perceptions and our memories rather than to formal logic'.²¹ Although Keynes, to the best of our knowledge, does not develop this idea elsewhere, he ponders the possibility that our expectations are determined by a 'natural' selection mechanism, i.e., through a trial and error-elimination process similar to Popper's evolutionary theory of knowledge and learning (PTKL). Be that as it may, in the same quotation he seems to stick to an inductive theory of knowledge:

'But in attempting to distinguish "rational" degrees of belief from belief in general [Ramsey] was not yet, I think, quite successful. It is not getting to the bottom of the principle of induction merely to say that it is a useful mental habit' (Keynes, 1973*a*, p. 339).

As Bateman (1987, p. 107) suggests, while accepting the subjective nature of our 'degrees of belief', Keynes implies that consistent subjective 'degrees of belief' are *not* rational. Rationality in the *Treatise* stems from the fact that probabilities are assumed to have been *inferred* correctly from the evidence available. By contrast, the rationality of probabilities in Ramsey's framework stems from their *consistency* according to the rules of calculus of probabilities.²² In a similar vein, Andrews (1999, p. 8) argues that Keynes believed that Ramsey's subjective theory of probability failed to distinguish 'rational' belief from belief in general. The reason is that Keynes continued to adopt an inductive theory of knowledge and, hence, to associate 'rationality' with probabilistic knowledge.

Notwithstanding it, Keynes eventually adopted Ramsey's (as well as Hume's) view of rationality. Ramsey (1978[1931], p. 96) argues that 'the human mind works essentially according to general rules and habits', denotes 'human logic' as the 'logic of truth' or 'inductive logic', and states that 'induction is such a useful habit, and so to adopt it is reasonable' (*op. cit.*, p. 100). However, this is remarkably similar to Hume's approach to rationality. Indeed, Ramsey explicitly makes the connection between rationality and induction when he refers to Hume:

'Hume showed that it [induction] could not be reduced to deductive inference or justified by formal logic. So far as it goes his demonstration seems to me final; and the suggestions of Mr Keynes that it can be got round by regarding induction as a form of probable inference cannot in my view be maintained. But to suppose that the situation which results is a scandal to philosophy is, I think, a mistake... We are all convinced by inductive arguments and our conviction is reasonable because the world is so constituted that inductive arguments lead on the whole to true opinions' (*op. cit.*, pp. 98-99).

Thus, Ramsey equates 'reasonable' behaviour with the use of inductive methods and, in this way, he seems to subscribe Hume's conclusion that, despite the absence of an 'inductive logic', there is a nevertheless a 'human logic' that is essentially inductive, i.e., individuals make use of induction to make decisions. We interpret his insistence on induction as a kind of pragmatism:

'We all agree that a man who did not make inductions would be unreasonable: the question is only what this means. In my view it does not mean that the man would in any way sin against formal logic or formal probability; but that he had not got a very useful habit, without which he would be very much worse off, in the sense of being much less likely to have true opinions' (*op. cit.*).

What is important for our purposes is that, as we noted above, Keynes not only accepted Ramsey's critique of his notion of objective logical probability relations but he ended up adopting by 1938 a theory of human behaviour similar to both Ramsey's and Hume's.²³ In *My Early Beliefs* (Keynes, 1973a, pp. 433-51), Keynes recalls the views of human nature held by the 'Old Bloomsbury' and charges himself and his friends at

the 1938 Memoir Club meeting with holding ideas that were 'disastrously mistaken' in the sense that it presupposed the idea that:

'The human race already consists of reliable, decent people, influenced by truth and objective standards, who can be safely released from the outward restraints of convention and traditional standards and inflexible rules of conduct, and left, from now onwards, to their own sensible devices, pure motive and reliable intuitions of the good' (*op. cit.*, p. 447).

The alternative view he adopts is as follows:

'We were not aware that civilisation was a thin and precarious crust erected by the personality and the will of a very few, and only maintained by rule and conventions skilfully put across and guilefully preserved' (*op. cit.*, p. 447).

The adoption by Keynes in his later economic writings of a *conventional* theory of beliefs and human behaviour is, for most purposes, tantamount to Hume's view that individual behaviour is grounded on 'custom and habit'. In other words, conventions or 'custom and habit' are two examples of factors which affect human behaviour *whose institutionalization can be ascribed ultimately to the fact that repeated observation (i.e., induction) has highlighted that their adoption yields desirable results*. The paradox is that Keynes's main intention in the *Treatise* was to answer both Hume (1978[1739-40]) and Moore (1912) by propounding a solution to the 'problem of induction' and an ethics that were not based on the adoption of social rules. Notwithstanding it, his capitulation to Ramsey implied, as we will see below, that he ended up adopting a theory of human behaviour based on the reliance by individuals on conventions where any pretension to Platonic-like 'objective' rationality was abandoned and replaced by a modest claim to 'reasonable' behaviour.

3.2. Ramsey's theoretical framework

The rest of this section is devoted to exploring other aspects of Ramsey's essay *Truth & Probability* which may also have a bearing on the methodology of economics beyond the above-mentioned impact on the development of probability theory. More precisely, we will argue below that Ramsey (1978[1931]) introduces a methodological

principle that exhibits a remarkable similarity to Popper's 'Rationality Principle'. Since Keynes (1973a, pp. 433-51) read Ramsey's essay, it is quite likely that the approach to modelling behaviour in the social sciences that Ramsey sketches in that piece had an impact on Keynes's thought. We reproduce below the crucial textual evidence in *Truth & Probability*:

'In order therefore to construct a theory of quantities of belief which shall be both general and more exact, I propose to take as a basis a general psychological theory, which is now universally discarded, but nevertheless comes, I think, fairly close to the truth in the sort of cases with which we are most concerned. I mean the theory that *we act in the way we think most likely to realize the objects of our desires*, so that a person's actions are *completely* determined by his desires and opinions. This theory cannot be made adequate to all the facts, but it seems to me a useful approximation to the truth... I only claim for what follows approximate truth, or truth in relation to this artificial system of psychology which like Newtonian mechanics can, I think, still be profitably used even though it is known to be false' (Ramsey, 1978[1931], p. 75, emphasis added).

There are several ideas in the previous paragraph which deserve our attention. First, the *general psychological theory* Ramsey propounds, 'the theory that we act in the way we think most likely to realize the objects of our desires' is remarkably similar to Popper's *RP* according to which 'our actions are adequate to our problem-situations as we see them' (Popper, 1994, p. 181). Notably, Popper says explicitly that he views his *RP* as the animating part of any social theory just as the laws of motion of planets are an integral part of Newton's gravitational theory (Popper, 1994, p. 177) whereas Ramsey makes an analogy between his general psychological theory and Newtonian mechanics and adds that both theories are 'approximately' true. In this respect, both Ramsey and Popper recognize that the principle they propound is either a good enough (Popper) or a useful (Ramsey) approximation to the 'truth' and, for both of them, the status of the principle is *methodological*. That said, there are, at least, two differences between these two versions of the principle. First, Ramsey emphasizes the uncertainty surrounding the consequences of our actions when he proposes that we behave in the way we think *most likely* to fulfil our desires, whereas the presence of uncertainty in Popper's *RP* is more subtle in that it is fully absent from the 'objectivist' version (*RPo*) but is present in the

`subjectivist' version (*RPs*) insofar as there may be a `wedge' between the objective P-S and agents' view of it. Second, Ramsey (*op. cit.*) stresses the purposefulness of human action and then argues that the latter is *completely* determined by our desires and beliefs without any consideration being paid to the P-S, whereas Popper makes P-S the centre of his proposal by stating that `our behaviour is adequate or appropriate to the P-S we face' and, hence, he implicitly denies that human behaviour is completely determined by desires and beliefs.

These ideas are depicted in Table 1 below which shows a tentative classification of probability theories and the resulting approaches to rationality. Keynes's approach to probability and rationality in the *Treatise* is shown in the first row. As it turns out, the theory that emerges can be interpreted as being both a positive and normative approach to rationality. As we suggested above, Keynes's approach to rationality in the *Treatise* implies fulfilment of means-rationality and beliefs-rationality. Next, both Ramsey and Keynes (in the wake of *Truth and Probability*) adopt a *dualistic* approach to probability in the sense that they believe that the adoption of the frequency approach to probability is legitimate in the natural sciences but inappropriate in philosophy (Ramsey) or in the moral sciences (Keynes).²⁴ Furthermore, as we showed above, the main implication of Ramsey's critique of the *Treatise* is Keynes's acceptance of the notion that probabilities are subjective. In turn, we believe the former implies that any normative pretension was abandoned by Keynes thereafter since: (i) the adoption of a subjective epistemological probability theory cannot imply fulfilment of `beliefs-rationality', and (ii) fulfilment of means-rationality can only be understood as implying that behaviour is *consistent* with one's desires and beliefs. Thus, we may characterize the theoretical framework Keynes adopted in the aftermath of *Truth & Probability* as being essentially `positive'.

Probability Theory		Nature of probability theory	Status of theory	Type of rationality	Popper's rationality principle
Keynes's <i>Treatise on Probability</i> (1920)		Objective & epistemological	Positive & normative	Means-rationality & beliefs-rationality	—
Ramsey's critique of Keynes's <i>Treatise</i> (1931)	Philosophy	Subjective & epistemological	Positive	Ends-rationality, means-rationality & beliefs-rationality	Subjectivist version
	Frequency theory (physics)	Objective & aleatory	Positive	—	—
Keynes's later economic writings (1936, 1937)	Frequency theory (natural sciences)	Objective & aleatory	Positive	—	—
	Conventional theory (moral sciences)	Inter-subjective & epistemological	Positive	Ends-rationality & means-rationality	Subjectivist version

Table 1. Classification of probability theories in Keynes's and Ramsey's work

Similarly, Ramsey's framework can be interpreted as being a positive approach. It is essentially a 'logic' for thinking about human behaviour under the premise that the latter is purposeful and consistent with one's objectives and beliefs. As such, Ramsey's framework implies fulfilment of both 'ends-rationality' and 'means-rationality' but not 'beliefs-rationality'.²⁵ Unlike in Savage's (1954) framework, Ramsey does not assume that the individual knows the consequences of adopting each possible course of action. Therefore, and unlike Savage's framework, the absence of 'beliefs-rationality' prevents Ramsey's framework from representing a normative theory. Further, the 'logic' Ramsey (1931[1978]) propounds to explain human behaviour and which was reproduced in the previous footnote implies that his approach represents an instance of what we defined in Ayala & Palacio-Vera (2015) as *RPs* in the sense that the theoretician reconstructs P-S as 'she believes the agent believes it is'. Though we do not wish to dwell on it, the adoption by Savage (1954) of Ramsey's subjective epistemological interpretation of probability was coupled to the development of a framework where agents are *assumed* to know the full consequences of adopting each possible course of action or where

economic agents exhibit 'beliefs-rationality'. Therefore, whereas we argued in Ayala & Palacio-Vera (2015) that Savage's framework is an instance of *RPO*, we believe instead that Ramsey's approach is an instance of *RPs*. Finally, last row in Table 1 below refers to the framework Keynes adopted in his later economic writings and which will be discussed in detail below. As some commentators recognize, in his later economic writings Keynes adopted an approach where economic agents are viewed as falling back on rules and social conventions that determine expectations and confidence formation. Though Keynes does not refer explicitly in those writings to probability theory, it has been suggested by Gillies (2000) that he adopts an *inter-subjectivist* interpretation of probability insofar as probability is subjective (as in Ramsey's theoretical framework) and the result of a complex process of interaction among the (interdependent) beliefs of a very large number of individuals. Finally, we argue in subsequent sections that the notion of rationality Keynes adopted in his later economic writings represents an instance of Popper's *RPs*.

4. Keynes after Ramsey: the nature and role of conventions and the methodology of economics

We showed above that Keynes's explicit capitulation to Ramsey's views in *My Early Beliefs* (Keynes, 1973a, pp. 433-51) heralded a new stage in his philosophical development. However, Keynes does not provide an explicit philosophical account of his views on human nature (Davis, 1994, p. 147). Since economics was the main focus of his intellectual activity in the last part of his life it is to economics that one must turn to investigate his later views on human nature. In this respect, it is widely recognized that, in his later economic writings, Keynes adopted a theory of conventional judgement and belief.²⁶ We have argued above that the former exhibits a remarkable similarity with Hume's dictum that human behaviour is ruled by 'custom and habit'. Notwithstanding it, we will argue below that Keynes's theory of conventional judgement and belief can be adjusted to make it compatible with PTKL. We also address below Keynes's later ideas on both the methodology of economics and the nature of its object of study as they emerge from a number of letters addressed to Tinbergen, Kahn and, especially, Harrod in the late 1930s.

4.1. The nature and role of conventional knowledge

An extensive discussion of the philosophical foundations of Keynes's thought is in Davis (1994). Along with several other commentators he argues that, in the wake of Ramsey's critique of his approach to probability in the *Treatise*, Keynes concluded that individual judgement required an anchoring in 'convention and traditional standards and inflexible rules of conduct' and that the only resource upon which people might draw to correct 'individual errors in judgement rested in a society's accumulated conventions, standards, and rules' (*op. cit.*, p. 104). Now, there are some characteristics of a society's conventions, standards and rules referred to in Keynes's later economic writings upon which Davis (1994, ch. 4) focuses: (i) that they go beyond the simple summaries of past experience that the frequency approach to probability makes central to probability, (ii) that they possess a *normative* character above their quality as statistical description, (iii) that they possess *objectivity* as opposed to Ramsey's subjectivist view of individual judgement as 'degree of belief', (iv) that they stem from *interdependent* judgement or mass psychology and, therefore, they presume the existence of a mechanism whereby individuals revise their judgements when they come into contact with the judgement of others and, finally, (v) that the formation of conventional expectations and confidence is a *dynamic* process. Our discussion below will focus on features (iii) through (v).

Now, according to Crotty (1994, p. 119), Keynes provides two main reasons for people's observed reliance on conventions, standards and rules. The first reason is that he views agents as 'socially and endogenously-constituted human beings' whose actual behaviour changes with circumstances in a *dialectical* and *interactive* way. The second reason is that conventions *lull our disquietude* by enabling us 'to hide from ourselves how little we can foresee'. In other words, the presence of radical uncertainty provokes disabling anxiety and the adoption of conventions helps mitigating this consciousness. As psychologists would put it, we do have a need to reduce our 'cognitive dissonance' (Festinger, 1957) and, to calm our nerves down, we collectively develop a conventional process of expectations and confidence formation. In the terminology of Choi (1993), the difficulty of finding an adequate 'paradigm' for ourselves encourages us to observe the paradigms that *other people* appear to use.²⁷ However, as Winslow (1989, p. 1180) notes 'conventions do not provide a rational foundation for long-run expectations; they are just "market place idols"' which help us substituting temporarily for the absence of knowledge. According to Keynes (1936, p. 152), the chief convention is the assumption that 'the existing state of affairs will continue indefinitely, except in so far as we have

specific reasons to expect a change'. Nevertheless, the most detailed discussion of conventional judgement and belief is in Keynes's 1937 *Quarterly Journal of Economics* paper where he delineates the ways in which individuals 'save their faces' as rational agents:²⁸

1. We assume that the present is a much more serviceable guide to the future than a candid examination of past experience would show it to have been hitherto. In other words, we largely ignore the prospect of future changes about the actual character of which we know nothing.
2. We assume that the existing state of opinion as expressed both in prices and the character of current output is based on a *correct* summing up of future prospects, so we can accept it as such unless and until something new and relevant comes into the picture.
3. Knowing that our own individual judgement is worthless, we endeavour to fall back on the judgement of the rest of the world which is perhaps better informed. That is, we seek to conform to the behaviour of the majority or the average. The psychology of a society made up of individuals each of whom is attempting to copy the others leads to what we may term a *conventional* judgement (Keynes, 1937, pp. 214-15).

Now, a few comments are in order. First, the assumption that agents believe that 'the existing state of affairs will continue indefinitely, except in so far as they have a specific reason to expect a change' captures, synthetically, bullet points 1 and 2 in the previous quotation. Yet, if we interpret this assumption as a behavioural hypothesis, it will only have empirical content if it is supplemented by a further assumption that tells us *how often* people have a specific reason to expect a change. For instance, if we argue that agents *almost never* have a specific reason to expect a change then, to the extent that individual behaviour tends to exhibit a stable pattern, the behavioural assumption will have high empirical content in the sense of exhibiting a high degree of testability. By contrast, if we argue that agents have a specific reason to expect a change *very often* so that individual is unlikely to follow a stable pattern, then the behavioural assumption has low empirical content (i.e., it exhibits a low degree of testability) and, hence, will be

of little use for modelling purposes. Presumably, Keynes (1937) implicitly assumed that economic agents *normally* do not have a specific reason to expect a change so that, most of the time, they tend to assume that the 'future will resemble the past'. Be that as it may, the frequency with which agents relax this assumption in the light of events that make them change their mind and believe that 'the future is unlikely to resemble the past' is an empirical issue and, to the best of our knowledge, Keynes does not express his views on it.

Our second comment is related to the 'homogeneity of human behaviour through time' implied by bullet points 1 and 2 above. As we will see in the following section, the main point of Keynes's epistolary exchange with both Tinbergen and Harrod is his argument that the *material of economics is non-homogeneous through time* which then becomes the core thesis of his attack on the methodological stance adopted by Robbins and which Keynes identifies with the 'natural science view' (Keynes, 1973b, pp. 299-300). The alleged non-homogeneity through time of the material of the social sciences stems from the fact that 'knowing that our own individual judgement is worthless, we tend to fall back on the judgement of the rest of the world' and that the 'psychology of a society made up of individuals each of whom seeks to copy the others' tends to make their judgement change unpredictably over time (Keynes, 1973b, pp. 214-15). In turn, the conventional nature of beliefs makes expectations and confidence exhibit instability as in a bootstrap equilibrium. That said, a commentator might object that Keynes may have incurred in a logical contradiction here. To be sure, if economic agents *normally* believe that 'the existing state of affairs will continue indefinitely' this will impart the economy with a high degree of stability and, hence, one would expect that the economic material exhibits a *high* (rather than a low) degree of homogeneity through time. However, we will argue below that this contradiction is only apparent and can be duly addressed if it can be shown that Keynes's theory is an instance of *RPs*.

Our third comment is related to our previous argument above that the approach to human nature that Keynes adopts in his later economic writings is similar to Hume's in the sense that, despite the absence of an 'inductive logic', Keynes, like Hume does, assumes that people tend to believe that the 'future will resemble the past'. To be sure, bullet points 1 and 2 above capture the idea Keynes *assumes* that economic agents tend to extrapolate the present into the future unless they think they have a specific reason for not doing so. However, it is the notion of *interdependent* beliefs (bullet point 3) that draws special attention in Keynes's later economic thought. As Davis (1994, p. 145)

writes, 'what is relevant here from that discussion [on the role of conventions] is the idea that conventions play a role alternative to inductive methods in enabling us to account for how the future is based on the past'. Rather, within the context of Keynes's theory of conventional judgement, induction must be viewed as 'being relative to the reasoning particular individuals exercised in particular historical contexts' (*op. cit.*, p. 146). Keynes's ideas into the conventional ways in which individual beliefs are formed are shown in the passage of the *General Theory* where he displays his 'Beauty Contest' metaphor and in which he explains the complex interactive mechanism through which the prices of financial assets are determined:

'Professional investment may be likened to those newspaper competitions in which the competitors have to pick out the six prettiest faces from a hundred photographs, the prize being awarded to the competitor whose choice most nearly corresponds to the average preferences of the competitors as a whole; so that each competitor has to pick, not those faces which he himself finds prettiest, but those which he thinks likeliest to catch the fancy of the other competitors, all of whom are looking at the problem from the same point of view... It is not a case of choosing those which, to the best of one's judgement, are really the prettiest, or even those which average opinion genuinely thinks the prettiest. We have reached the third degree where we devote our intelligences to anticipating what average opinion expects the average opinion to be. And there are some, I believe, who practise the fourth, fifth and higher degrees' (Keynes, 1936, p. 156).

As Davis (1997, p. 209) remarks, 'the idea that it is not the prettiest but those most likely to be thought the prettiest nicely captures the change in Keynes's view of judgement'.²⁹ Unlike the notion of 'rational degree of belief' he proposes in the *Treatise on Probability*, now the individual no longer intuitively grasps the [Platonic] quality of beauty, but rather she endeavours to form an interdependent judgement about what others facing the same dilemma may choose. In particular, each participant in the 'beauty contest' makes use of *introspection* to consider her own opinion, compares it to an opinion imputed to others, makes the necessary adjustments, and finally comes up with a new individual judgement that bears the imprint of mass psychology. In other words, according to this view, individual beliefs are constructed within a complex structure of *interdependent*

beliefs that works through an inter-subjective learning process whereby each individual ‘puts herself in the shoes of others’ to discover others’ beliefs.

4.2. The ‘rationality’ of conventional knowledge

The notion that individual behaviour tends to conform to the behaviour of the majority suggests that the former is based, at least partly, upon the *imitation* of others.³⁰ However, ‘rational’ economic agents will only tend to imitate behaviour they perceive as having proved *successful* in the past when was adopted by others. In turn, the former will normally be behaviour grounded on beliefs which have withstood the operation of trial and error-elimination processes. Keynes does not explain how some conventions come to be replaced by others and, hence, what we say here has to be understood as one possible (and certainly not the only one) development of Keynes’s ideas on this issue.³¹ Be that as it may, we believe that this characterization of conventional behaviour under uncertainty is compatible and, indeed, *complementary* with PTKL.³² As we explained in the previous chapter, the notion of rationality that stems from PTKL is characterised by *corrigibility*, i.e., the ability to eliminate one’s mistakes. Now, if individual beliefs are formed by comparing our beliefs to other people’s beliefs and, especially, to the beliefs of those people who appear to have been successful in particular endeavours in the past and, at the same time, those beliefs which are thought to have been discredited by the facts are not adopted, it turns out that the formation of conventional beliefs will tend to take place in a way that is reminiscent of PTKL.³³ Indeed, we believe that conventions, standards and rules can be viewed as *conjectures* or tentative hypotheses which emerge spontaneously as a response to a specific problem by virtue of a complex interactive process in which a large number of people participate. However, unlike the conjectures which are the usual object of PTKL (for instance, in the case of theories of scientific progress), conventions, standards and rules exhibit a profound *social* dimension in the sense that they are the outcome of a complex process of interdependent beliefs among a large number of individuals.

This profound social dimension and the fact that *only* those conjectures which agents believe not to have been discredited in the past will be adopted suggests that the conjectures which play a key role in Keynesian macro-theory exhibit a peculiar nature. For lack of a better name, let us denote them as ‘hegemonic conjectures’ (HC hereafter). Like other conjectures, HC will be preserved as long as economic agents believe that they are useful for addressing certain problems — presumably because they see them as

having been useful tools for guiding behaviour in the past — and, as long as they are preserved, they will confer stability and predictability to both individual and *collective* behaviour. In other words, we believe that the complex interactive process involving a large number of individuals that, arguably, characterises the formation of conventional beliefs in Keynes's theory *is compatible with PTKL once the thesis that such interactive process is essentially based upon a trial and error-elimination mechanism is accepted*. In consequence, we think that *individual behaviour which broadly accords with HC as suggested above is 'rational' provided it exhibits corrigibility*. That is to say, according to PTKL, the charge of 'irrationality' only applies to those individuals who consciously refuse to eliminate their errors. Similarly, in the context of Keynesian theory, the charge of 'irrationality' *only* applies to those individuals who abide themselves by conventions, standards and rules which are widely known to have yielded undesirable results in the past.³⁴

Our argument that Keynes's theory of conventional beliefs as it appears in his later economic writings is, at least *a priori*, compatible with PTKL is not contradicted by the idea expressed by Davis (1997, p. 217) that, according to Keynes, 'the conditions associated with states of confidence concern the success or lack of success with which individuals come to assess each other's opinions about markets'. That is, the success or lack of it is not related here to the relative past performance of behaviour based on the adoption of certain conventions but to the ability of individuals to reciprocally *discern* other people's opinions. In other words, the idea we presented in the previous paragraph is that, if Keynes's theory of conventional beliefs is to be made compatible with PTKL then this implies that people will tend to adopt those beliefs which appear not to have been discredited by the facts in the past whereas Davis (*op. cit.*) suggests that, according to Keynes, our *confidence* in a certain set of beliefs is a positive function of the success attained in reciprocally discerning other people's beliefs. In other words, the degree of success would operate here at two different levels: beliefs (including expectations), and the confidence with which those beliefs are held on average. In the former case, it is the apparent degree of success exhibited by a set of beliefs in the past that will determine whether or not those beliefs become 'hegemonic'. In the latter case, by contrast, it is the success in reciprocally discerning those beliefs, that is, the extent to which we manage to apprehend each other's beliefs, that determines how confident we are about them. Be that as it may, we believe that the confidence with which people hold a set of beliefs will also depend positively on *how widely* that set of beliefs comes to be held across

individuals. In turn, the *more widely held a set of beliefs is the more stable expectations will be* and, hence, it follows that the less widely held a certain set of beliefs is the more potential for macroeconomic instability there will be. With this, we believe we have a more encompassing theory of conventional judgement and belief with an evolutionary dimension and a capacity for enhancing and extending Keynes's macro-theory. On the one hand, the notion that the likelihood that a set of beliefs comes to be widely adopted by economic agents depends positively upon the extent to which they are seen as not having been discredited by the facts in the past provides Keynes's macro-theory with an *evolutionary* theory of conventional belief anchored in PTKL. On the other hand, the notion that the (average) level of confidence with which a set of beliefs is held depends *positively* on the ability of economic agents to reciprocally discern each other's beliefs and how widely those beliefs happen to be held provides Keynes's macro-theory with an explanation for changes in the (average) level of confidence.³⁵

4.3. Business cycles and the expansion of conventional knowledge over time

From our previous discussion it logically follows that HC may not be preserved indefinitely.³⁶ A HC will be replaced by another one whenever people *believe* that it no longer yields good results if adopted or when a sufficiently large amount of experience has accumulated which suggests that it is inadequate in the sense of apparently leading to undesirable results. If the convention to be replaced happens to be a convention upon which the evaluation of the long-term profit expectations of investors was based, then a period of crisis may ensue as investors increase substantially their *relative* demand for liquid assets (i.e., liquidity preference increases) in the aftermath of higher uncertainty about the future. In turn, an increase in the degree of liquidity preference will lead to a decrease in both the level of aggregate demand and economic activity. In the context of Keynes's macro-theory, an increase in the degree of liquidity preference is concomitant to a decrease in the marginal efficiency of investment. The demand for investment will decrease as both the marginal efficiency of investment decreases and the term premium embedded in financial assets and bank loan rates increases. The decrease in aggregate investment will initially lead to a decrease in aggregate output and income and this, in turn, will cause a further decrease in aggregate spending as aggregate consumption goes down due to the initial fall in aggregate disposable income. This way, the breakdown of a critical convention in the evaluation of long-term profits brings about a downturn in

the economy. Finally, the turbulent period will come to an end when the old convention is replaced by a *new* one.³⁷

4.4. The debate on the nature of economics and its object of study

A detailed discussion of Keynes's involvement in several controversies related to the role of induction and statistical methods in economics is in Bateman (1990). The importance of this controversy goes beyond the role of statistical methods in economics insofar as it highlights the ideas that Keynes held on economic methodology over the latest part of his life. Of particular interest to us is the exchange that Keynes had with Tinbergen in the late 1930s because it took place when Keynes had already rejected most of the ideas he advocated in the *Treatise* and soon after he published the *General Theory* and his famous 1937 *QJE* paper. Keynes wrote a number of letters addressed to Tinbergen, Harrod, and Kahn where he expounds his ideas unambiguously. To this, we may add that the controversy is of high interest from the point of view of the history of economic thought since Keynes's critique of Jan Tinbergen's work represented the first systematic assessment of the multiple regression analysis the latter pioneered and which has had such a far-reaching impact on the ulterior development of economics.³⁸

4.4.1. The non-homogeneity through time of economic data

It is not our purpose to reproduce in detail the terms of the exchange but only to summarize its main implications for Keynes's views on methodology. As Bateman (*op. cit.*) notes, in the Tinbergen controversy Keynes argued that there is no *a priori* reason to expect that the economic data used in statistical analysis is stable in the long run and, hence, that there is no reason for us to expect to infer stable correlations. This idea is expressed in the first letter Keynes addressed to the official of the League of Nations who had asked him to review Tinbergen's work in August 1938:

‘There is first of all the central question of methodology, —the logic of applying the method of multiple correlation to unanalysed economic material, which we know to be non-homogeneous over time. If we were dealing with the action of numerically measurable, independent forces, adequately analysed so that we knew we were dealing with independent atomic factors and between them completely comprehensive, acting

with fluctuating relative strength on material constant and homogeneous through time, we might be able to use the method of multiple correlation with some confidence... In fact, we know that every one of these conditions is far from being satisfied by the economic material under investigation' (Keynes, 1973*b*, pp. 285-86).

Further down in the same missive, Keynes adds:

'Is it assumed that the future is a *determinate* function of past statistics? What place is left for expectation and the state of confidence relating to the future?... What place is allowed for non-numerical factors, such as inventions, politics, labour troubles, wars, earthquakes, financial crisis? One feels a suspicion that the choice of factors is influenced (as is indeed only natural) by what statistics are available, and that many vital factors are ignored because they are statistically intractable or unprocurable' (*op. cit.*, p. 287, emphasis added).

Therefore, it seems that for Keynes, the alleged *non-homogeneity* of economic material through time stems from the fact that the latter can be affected by a potentially large array of *non-economic* factors which are not taken account of in statistical data. However, as we show below, Keynes also suggests in another letter addressed to Harrod in 1938 (Keynes, 1973*b*, p. 300) that such non-homogeneity of economic material over time stems from the fact that individual behaviour is based upon conventional beliefs which, by their nature, may change through time. In any case, Tinbergen's answer was that it can be assumed that non-economic factors affect economic variables in a *non-systematic* fashion (i.e., they cancel each other out in the long run) so that their effect on the latter can be duly taken account of in the stochastic term of the statistical model. In any case, as Bateman (1990) notes, Keynes's argument was not that the entire project of Tinbergen should be abandoned but that it needed to adopt a more inductive basis. In particular, as he explained twenty years before in Chapter 33 of the *Treatise*, he argued that, in order to carry out statistical inductions, we must previously examine series of series of economic data in order to determine whether the distributions of the variables are stable in as many circumstances as possible.³⁹ Be that as it may, Bateman (*op. cit.*, p. 378) concludes that Keynes was not opposed to Tinbergen's econometric work but only to attempts at statistical inference that were not preceded by a previous analysis aimed at ascertaining the suitability or otherwise of the data for making such inferences.

4.4.2. Keynes's view of the nature of economics and its methodology

Next, after having shown above why Keynes thought that the economic material is not homogenous through time we turn to discussing his views on the methodology of economics. According to us, there are three main ideas that emerge from the two letters that Keynes addressed to Harrod in 1938 (Keynes, 1973*b*, pp. 295-300).⁴⁰ The first idea is his claim that 'economics is a science of thinking in terms of models joined to the "art of choosing models" which are relevant to the contemporary world'. The second idea is his claim that the objective of economics is not so much to 'predict' but to explain. The last idea is his notion of economics as a 'moral science' (in opposition to the 'natural science view' that Keynes attributes to Lionel Robbins) which deals with introspection, motives, expectations, and psychological uncertainties. We will argue below that these three ideas highlight that Keynes's view of economic models exhibits some similarities with Popper's.

Firstly, we noted in Ayala & Palacio-Vera (2015) that, building upon Hayek's distinction between 'explanation in principle' and 'explanation in detail' (Hayek, 1967*b*), Popper (1994, p. 163) distinguishes between the problems of explaining or predicting *singular events* and the problems of explaining or predicting a *kind* or *type* of event.⁴¹ According to him, the former can be solved *without constructing a model* — only certain universal laws and the relevant initial conditions are needed — whereas the latter is most easily solved *by constructing a model* (*op. cit.*, p. 164). That is, Popper shares with Keynes the view that models are, arguably, the most important instrument for analysis in the social sciences, including economics. Furthermore, he argues that in the context of the social sciences models consists of 'certain elements placed in a typical relationship to each other, plus certain universal laws of interaction — the "animating" laws' (*op. cit.*, p. 165). It is at this point where there is a difference between Keynes and Popper in their respective views of models in that Popper is more specific than Keynes is as to *what* a model must contain: (i) certain elements of the P-S placed in a typical relationship to each other, and (ii) the 'rationality principle'. By contrast, Keynes does not allude to an 'animating law' and says that 'the object of a model is to segregate the semi-permanent or relatively constant factors from those which are transitory'. Yet, we will argue below that the 'rationality principle' is implicit in Keynes's macro-theory.

Secondly, we have shown above that Popper argues that models seek to capture the *typical* aspects of a P-S with a view to making statements about a *type* of event and,

consequently, that they represent something akin to *typical initial conditions* (*op. cit.*, p. 164). He then adds that a statement about a *typical* event can be either an explanation of *why* that typical event occurred in the past, or a prediction. However, further down he makes it clear that ‘the fundamental problem of both the theoretical and the historical social sciences is *to explain and understand events in terms of human actions and [typical] social situations*’ (Popper, *op. cit.*, p. 166). The latter leads Notturmo (1998, p. 412, emphasis added) to argue that the ‘problem of situational analysis in the theoretical and historical social sciences, in Popper’s view, is not to construct models that predict or prophesize the future; it is to construct models that help us *explain and understand the past*’. Now, we think we need to distinguish at this stage between ‘predictions’ and ‘forecasts’. As Beinhocker (2013) notes, in the theoretical social sciences, a ‘prediction’ (as opposed to a ‘forecast’) amounts to deriving the *deductive logical consequences* of a theory. When Popper makes a distinction between problems of explaining or predicting *singular events* from problems of explaining or predicting a *type* of event, we think he really means that forecasting, as opposed to deriving the deductive logical consequences of a theory, is *not* generally possible in the social sciences.⁴² More specifically, the main problem of using models in the social sciences for forecasting purposes stems from the fact that they use *typical* initial conditions. Accordingly, we believe that Popper makes use of the term ‘prediction’ in the quotation above to refer to a legitimate objective of both the natural and the social sciences but his next comment further down in the same essay suggests he should have distinguished between ‘prediction’ in the natural sciences which amounts to ‘forecasting’ and ‘prediction’ in the social sciences which consists of the derivation of the deductive logical consequences of a theory. If our interpretation is correct, then Popper’s position is rather similar to the position Keynes advocates when he makes it clear that ‘the object of statistical study is not so much to fill in missing variables with a view to prediction, as to test the relevance and validity of the model’ (Keynes, 1973*b*, pp. 295-6).

The third and last idea we identified above is Keynes’s notion of economics as a ‘moral science’ in contrast to the ‘natural science’ view that Keynes seems to attribute to Robbins. Firstly, Keynes argues that ‘the pseudo-analogy with the physical sciences leads directly counter to the *habit of mind* which is most important for an economist proper to acquire’ (Keynes, 1973*b*, p. 299, emphasis added). Next, he emphasizes that economics is a moral science’ and makes it clear that it deals with *introspection, values, motives, expectations and psychological uncertainties* (*op. cit.*, p. 300). He then closes

the paragraph with a metaphor whereby he explains why the material of economics is not homogeneous through time:

‘One has to be constantly on guard against treating the material as constant and homogeneous. It is as though the fall of the apple to the ground depended on the apple’s motives, on whether it is worth while falling to the ground, and whether the ground wanted the apple to fall, and on mistaken calculations on the part of the apple as to how far it was from the centre of the earth’ (Keynes, 1973*b*, p. 300).

That is, he seems to argue that the non-homogeneity through time of the material of economics stems mainly from the fact that, being a ‘moral’ science, economics deals with the motives, expectations and psychological uncertainties of economic agents, all of which are *subjective* and, crucially, liable to experience unpredictable changes.⁴³ By contrast, and building upon Hayek (1942, 1943), we argued in Ayala & Palacio-Vera (2015) that the ‘natural’ sciences deal with *objective* facts in the sense that their nature is (largely) independent of the viewpoint of the observer and which, by their nature, are unlikely to undergo unpredictable changes. Now, we believe that the quotations reproduced above suggest that the ‘habit of mind’ that Keynes thinks is important for economists (and we add social scientists) to acquire is precisely the methodological position we associated in Ayala & Palacio-Vera (2015) with *RPs*, i.e., with the view that the social scientist should try to reconstruct P-S not as she believes it is (objectively) but, instead, as she believes that agents *believe* it is.

5. Keynes’s views on economics and the ‘rationality principle’

The main purpose of this section is to argue that Keynes’s view of economics as a ‘moral’ science and the ‘natural science view’ he associates with Robbins (1932) exhibit an analogy with the ‘subjectivist’ and ‘objectivist’ version of *RP* respectively. More specifically, we will argue below that Keynes’s macro-theory can be interpreted as an instance of *RPs*. We will also argue that Keynes’s attempt to distinguish his view of economics as a ‘moral’ science by emphasizing the role introspection plays in the former is misleading. In this respect, Robbins is known for his defence of the key role introspection plays in allowing us to grasp the premises upon which economic theory is grounded.⁴⁴ In other words, we think that introspection also plays a role in neoclassical economics and that the difference between Keynes’s view of economics as a ‘moral’

science and his view of neoclassical theory as an approach that employs a methodology that resembles the 'natural' sciences has to be ascribed to other characteristics of these approaches. In particular, we will argue below that the key difference between these two approaches lies in their respective adoption of *different* versions of *RP*.

5.1. The role of introspection in neoclassical economics

If we identify the approach Keynes associates with Robbins with neoclassical economics then, it is clear that, as Robbins (1932) argues, the role of introspection is to grasp the basic human dispositions upon which the theoretician must build her models. For instance, in terms of the framework presented in the previous chapter, introspection is the source of the notion that individual behaviour exhibits both 'ends-rationality' and 'means-rationality'. In the case of 'ends-rationality', we noted above that, following von Mises (1944), human behaviour is *purposeful* or oriented towards the achievement of certain aims. Likewise, in the case of the notion of 'means-rationality', we defined it as the idea that individual behaviour is *consistent* for a given set of beliefs and objectives. We made it clear that fulfilment of ends- and means-rationality is common to models that adopt either *RPO* or *RPs* in that, in both cases, the behaviour of agents is assumed to be purposeful and adequate to the P-S. Yet, we also argued that a common feature of all the theoretical models that adopt *RPO* is that the theoretician 'imposes' her view of P-S upon the agents. This means that, in addition to fulfilment of both 'ends-rationality' and 'means-rationality', economic agents are also assumed to exhibit 'beliefs-rationality'. In other words, agents are assumed to exhibit 'substantive' rationality (Simon, 1976). As we explained, the modern neoclassical version of this approach to rationality is captured in Subjective Expected Utility (SEU) theory (Savage, 1954), which entails that agents know the consequences of all possible courses of action under every 'state of the world' so that the only source of uncertainty is the (subjective) probability that agents attach to the latter. However, and unlike the notions of 'ends-rationality' and 'means-rationality', *we believe that the assumption of 'beliefs-rationality' does not stem from introspection. Rather, the latter is an 'artefact' of the theoretician aimed at closing her model in a way that testable predictions can be generated.* That is, by assuming that economic agents exhibit 'substantive' rationality, the theoretician can 'close' her theoretical model in a way that clear testable predictions can be derived.⁴⁵ But, crucially, in order to do so, the theoretician has to ignore the fact that we can *never* be sure that our knowledge is 'true', i.e., that there is not an 'inductive logic'. As we argue below, Keynesian theoreticians

do not assume there is an 'inductive logic' and, for this reason, they do not assume that agents exhibit 'beliefs-rationality'. We will also argue that, in order to circumvent this barrier they resort to a particular type of introspection; they 'put themselves in the shoes of economic agents' so that they can get an idea of *how* they make decisions in the face of uncertainty.

5.2. Keynesian uncertainty and the 'logic of induction'

We have argued that the adoption of the assumption of 'beliefs-rationality' in neoclassical economics logically implies that the theoretician *assumes* that there is an 'inductive logic', i.e., she believes that she can obtain 'true' knowledge by extrapolating the information of the past into the future.⁴⁶ 'True' knowledge in this context means that every economic agent is (i) assumed to possess an exhaustive list of possible 'states of the world', and (ii) can attach numerical probabilities to each of them. But, surely, *such alleged 'true' knowledge can only come from the past*. Where else could it come from? By contrast, Hume (2006[1748]) showed long time ago that such an 'inductive logic' does not exist. Thus, in neoclassical models — or the models that Keynes associates to the 'natural' science view — the theoretician reconstructs P-S 'as if' agents believed that an 'inductive logic' exists.

We have noted that the assumptions of 'ends-rationality' and 'means-rationality' are shared by models that adopt *RPo* and *RPs* and, consequently, that all such models make use of introspection. The difference between neoclassical and Keynesian models must thus lie elsewhere. Unlike neoclassical theoreticians, Keynesian theoreticians do not assume that agents exhibit 'beliefs-rationality'. Rather, they assume that agents have to make decisions in a context of 'uncertainty' in the sense of both Keynes (1920) and Knight (1971[1921]).⁴⁷ That is, as opposed to SEU theory, in Keynes's macro-theory economic agents do not possess an exhaustive list of possible 'states of the world', do not know the full consequences of adopting different courses of action under different circumstances and cannot attach numerical probabilities to all the possible 'states of the world'. The reason for the existence of 'uncertainty' is usually associated to Keynes's assumption that 'economic data is not homogenous through time' or, in more technical terms, to the non-ergodic nature of the world.⁴⁸ The latter implies that the 'future will not resemble the past' and, hence, the impossibility of knowing the full consequences of adopting different courses of actions under different 'states of the world'. However, *we believe that the ultimate cause of the existence of genuine uncertainty in the economy is*

not so much the absence of homogeneity through time of economic data but the absence of an 'inductive logic'. In other words, 'uncertainty' is ultimately implied by Popper's claim that all knowledge is *conjectural* and, hence, provisional. Even if we observe that economic data is homogeneous through a long period of time we cannot claim that the former will continue to be homogeneous in the future. In the absence of an 'inductive logic' we can never claim that 'the future will resemble the past'. Such claims can only be *conjectural*. However, this may also be applied to the opposite claim, that is, to the claim that economic data is *not* homogeneous through time. To be sure, if Keynes's claim that economic data is not homogeneous through were 'true' the former would be a powerful reason for making us be uncertain about the future. Yet, the former is only a conjecture that may eventually turn out to be false. That is, it is a conjecture. Thus, there is a *deeper* reason for being uncertain about the future than the possibility that the world is not ergodic; *we cannot guarantee that the 'future will resemble the past'.* In short, according to us, the primary source of genuine uncertainty in a market economy is not the alleged non-homogeneity through time of economic data but the fact that, due to the lack of an 'inductive logic', we cannot guarantee that the 'future will resemble the past'.

5.3. Mainstream criticisms of Keynesian macro-theory

By assuming that the 'future will not resemble the past' Keynesian theoreticians have been exposed to the criticism that, since economic agents cannot confidently use the information obtained from the past to prophesize the future, their beliefs cannot be fully specified in their models (i.e., the theoretician cannot assume that economic agents exhibit 'beliefs-rationality') and, hence, no forecasts can be derived because economic agents' decisions will depend on 'exogenous' and, hence, unpredictable changes in their beliefs. In particular, Keynesian macro-theory has often been denoted as 'nihilistic' by some neoclassical economists (Coddington, 1982) allegedly because, by assuming that the 'future will not resemble the past', Keynesian macro-models are unable to generate testable predictions. However, we believe the accusation of 'nihilism' is unjustified. As we explained above, the implicit adoption by neoclassical economists of a modelling approach based on *RPO* and the construction of models based upon the assumption that economic agents exhibit 'substantive' rationality allows them to generate neat testable predictions.⁴⁹ Yet, we argued in Ayala & Palacio-Vera (2015) that the adoption of *RPO* implies that the theoretician 'imposes' on the agents her view of P-S. More specifically, and given the absence of an 'inductive logic', we argued that the assumption that agents

exhibit 'beliefs-rationality' entails the 'imposition' of the theoretician's view of P-S upon them.

Next, Keynesian theoreticians *do adopt RPs instead of RPs*. As we argued in Ayala & Palacio-Vera (2015) the adoption of *RPs* implies that the theoretician seeks to reconstruct P-S as 'she believes that economic agents believe it is'. We have also argued above that Keynesian theoreticians *believe* that the 'future will not resemble the past'. Rather, *they believe that economic agents believe the opposite*. Specifically, Keynesian theoreticians observe that, in spite of the fact that the 'future will not resemble the past', this does not prevent economic agents from actually making decisions. According to them, economic agents *make decisions because, most of the time, they 'ignore' that the 'future will not resemble the past'*. Further, *they 'ignore' it for good reasons; if they did not, they would be paralyzed!* At this stage, Keynesian theoreticians are 'forced' to rely on introspection in order to adopt agents' viewpoint, i.e., to adopt *RPs*. That is, instead of 'imposing' on agents their view of P-S — which as we argued above is the strategy implicitly adopted by neoclassical economists — they 'put herself in the shoes of economic agents' in order to understand *how* they make (often good) decisions in spite of the genuine uncertainty they face. For lack of a better name let us denote this type of introspection as *empathic* introspection.

We may add to this that, although the adoption by Keynesian theoreticians of the viewpoint of agents stems from their need to understand *how* the latter make decisions in spite of finding themselves in a situation of genuine uncertainty there is an even more fundamental reason for doing so. As we remarked in the previous chapter, Hayek (1942, 1943*a*) claims there are no objective 'facts' in the social sciences because, in the latter, 'things are what people believe they are'.⁵⁰ However, if 'things are what people believe they are', it seems to us that the natural strategy for the theoretician is to 'put herself in the shoes of agents'. It was for this reason that we argued in Ayala & Palacio-Vera (2015) that the adoption of *RPs* is the natural approach in the social sciences. To this, let us add that Hayek (1943*a*) insists that the theoretician does not possess herself any information that is not possessed by the agents themselves. Therefore, the adoption of *RPs* rather than *RPo* in the social sciences can be advocated not only on the grounds that, owing to the lack of an 'inductive logic', the theoretician needs to rely on 'empathic' introspection to acquire knowledge about *how* economic agents make decisions in a context of genuine uncertainty. The adoption of *RPs* instead of *RPo* can also be defended on the grounds that: (i) the P-S that agents face is 'as they see it' rather

than as the theoretician sees it, and (ii) the theoretician does not possess any information that is not possessed by the agents.

Next, the assumption Keynes (1936, p.152) makes according to which economic agents believe 'the existing state of affairs will continue indefinitely, except in so far as they have specific reasons to expect a change' does not prevent him, however, from generating testable predictions. We thus believe that the charge of nihilism thrown upon Keynesian macro-theory by neoclassical economists is unwarranted. Some examples of testable predictions that stem from Keynesian macro-theory are the following: (i) the inability of money wage cuts to eliminate involuntary unemployment and their potential destabilizing effects, (ii) the ineffectiveness of monetary policy during recessions, and (iii) the existence of involuntary unemployment due to too high real (long-term) interest rates rather than to 'too high' real wages. These predictions have to be understood as the 'logical implications' of the theory which stem from the premise that economic agents' long-term expectations and confidence are formed *conventionally* and, hence, they are given in the short term. As Crotty (1994) argues, it is the stability and predictability that social conventions confer to individual and collective economic behaviour that provides the behavioural foundations for Keynesian macro-modelling. Specifically, the adoption of social conventions by agents helps generate orderly and stable patterns of economic behaviour across individuals thus opening up the possibility of doing macroeconomic analysis. He denotes the stability generated by decision-making under uncertainty based on conventional behaviour as 'conditional' stability and defines it as a situation where *behavioural equations are stable under conditions that hold most of the time* but which, at the same time, as in the celebrated Minsky's (1982) 'financial instability hypothesis', creates the conditions for occasional bouts of macroeconomic instability.

Lastly, the accusation by some mainstream economists that Keynesian macro-models are made up of economic agents who behave 'irrationally' is also, according to us, a direct consequence of the fact that, unlike in neoclassical economics, in Keynesian macro-theory economic agents are not assumed to exhibit 'substantive' rationality. In other words, Keynesian economic agents are not optimizers and, from the standpoint of neoclassical theory, this is tantamount to 'irrationality' (Becker, 1962). However, we believe the association of 'rational' behaviour with optimizing behaviour is arbitrary. To be sure, this notion of rationality does not stem from philosophy of science but from a concrete tradition in the history of economic thought: neoclassical economics. As we have argued above, such notion of rationality *presupposes* that there is an 'inductive

logic' theoreticians can take advantage of. In particular, if the existence of an 'inductive logic' is assumed, the theoretician can assume that she can acquire 'true' knowledge about P-S which, when combined with the knowledge she can obtain *via* introspection about the basic premises of human behaviour, allows her to construct models where she 'imposes' upon the agents her alleged 'true' view of P-S. However, if the existence of an 'inductive logic' is denied, such 'true' view of P-S becomes unattainable. We have argued above that Keynesian theory does not presume the existence of an 'inductive logic'. In particular, we argued that Keynesian theoreticians believe that the 'future will not resemble the past' yet they realize that economic agents make decisions in spite of it. It is for this very reason that Keynesian theoreticians adopt *RPs*, that is, they resort to 'empathic' introspection in order to understand *how* agents behave. Their main result is that economic agents fall back on social conventions to make decisions. But, crucially, reliance by economic agents on conventional knowledge in the absence of an 'inductive logic' does by no means imply that their behaviour is 'irrational'. Rather, in the absence of an 'inductive logic' such behaviour is 'rational' insofar as the former is *coherent with economic agents' belief in the presence of a high degree of stability and predictability in economic affairs*. We conclude that the charge of 'irrational' behaviour by economic agents in Keynesian macro-models made by some neoclassical economists is arbitrary and, hence, unwarranted.

5.4. Keynesian macro-theory in the light of Popper's Rationality Principle

The modelling technique adopted by Keynesian theoreticians which we denoted above as 'empathic' introspection constitutes a heuristic device the theoretician relies on to gain understanding of what is a very complex process.⁵¹ Thus, in Keynesian macro-theory the role of introspection is two-sided: (i) to gain insight into the motivations of individual behaviour in the fashion of neoclassical economists by taking advantage, as Hayek (1943*b*) would put it, of the existence of an *analogy* between the mind of the theoretician and the mind of the other human beings, and (ii) to 'put oneself in the shoes of others' to understand *how* economic agents behave *in different circumstances*, i.e., to adopt their viewpoint. Now, according to Keynesian macro-theory, there are two main *typical* situations economic agents may 'believe' to find themselves in:

1. Situations characterised by the absence of a significant discrepancy between expectations and realised outcomes which makes economic agents 'believe'

that the past is a *good enough* guide to the future. In such situations, economic agents will tend, perhaps unconsciously, to extrapolate the past into the future. Confidence will be high and liquidity preference low. These are the so-called 'tranquillity' periods.

2. Situations characterised by the presence of a significant discrepancy between expectations and realised outcomes which makes economic agents 'believe' that the past *is not a valid guide to the future*. The former will typically lead to the breakdown of previously-held conventions as well as to the search for new conventions upon which to ground decision-making. Confidence will be low and liquidity preference high. These are the so-called 'turbulence' periods.

As we noted above, 'tranquillity' periods provide the foundations for Keynesian macro-modelling. In particular, and following Crotty (1994), we denoted the stability that results from decision-making under uncertainty based on conventional behaviour as 'conditional' stability. In turn, we have pointed out that 'conditional' stability refers to a situation where behavioural equations are stable under conditions *that hold most of the time but which may unpredictably 'break down'* in the aftermath of the occurrence of occasional bouts of macroeconomic instability. Consequently, Keynesian macro-theory recognizes the inherent instability of decentralized market economies and, hence, the inability of macroeconomic models to become a tool for macroeconomic forecasting. The purpose of theory is not, according to Keynesian theory, to generate quantitative forecasts but to generate 'predictions' or logical implications of the theory which help us understand *how* market economies work and which can, in turn, serve as a basis for policy analysis.

Next, there are several elements of Keynes's macro-theory which, according to us, lend support to our claim that it constitutes an instance of *RPs*. First, and foremost, there is his 'Beauty Contest' metaphor (Keynes, 1936, p. 156). The standard theory in economics for the formation of financial asset prices is that the latter represent the discounted stream of the future expected capital income they will generate for asset holders. But this is how the theorist *believes* financial asset prices are 'objectively' set. By contrast, as we have noted above, Keynes argues that the prices of financial assets are determined largely by the *speculative* behaviour of financial market participants. In particular, he claims that the decision of market participants to either sell or purchase a

financial asset depends on: (i) her perception as to whether there is a 'bull' or a 'bear' market (i.e., whether she expects asset prices to rise or fall in the near future) and, (ii) particularly, her beliefs about how the other market participants think that asset prices are likely to behave in the near future as well as her beliefs about *how* other market participants believe that other market participants, in turn, expect asset prices to behave. To summarize, Keynes's theory of financial asset prices is built upon the notion that the latter are set by a complex interactive process characterised by the interdependency of conventional beliefs among a very large number of financial market participants. But, in our view, this insight stems from the fact that Keynes *adopts the point of view of market participants to understand how they behave* or, put another way, he 'puts himself in the shoes of financial market participants'.⁵² Yet, 'putting himself in the shoes of economic agents' is, according to us, what the macroeconomist does if he adopts *RPs*.

According to us, there are other instances of the theoretician 'putting herself in the shoes of the agents' in Keynes's theory. Firstly, there are the so-called 'fundamental psychological laws' to which he alludes in his *General Theory*: (i) the psychological propensity to consume,⁵³ (ii) the psychological attitude to liquidity preference, and (iii) the psychological expectation of future yield from productive capital-assets. The first law corresponds to households, the second one corresponds to speculators, and the third one corresponds to entrepreneurs. In all three cases, the behaviour of economic agents towards consumption, liquidity and long-term investment is a 'rational' response to the *uncertainty* they face. However, it is in the last two psychological laws that the adoption by the theoretician of the viewpoint of economic agents is clear. To be sure, economic agents' liquidity preference and long-term profit expectations are closely related to their 'confidence' where the latter is a *subjective* measure of the 'degree of completeness' of the factual evidence on which their (uncertain) beliefs are based.⁵⁴ Specifically, the lower agents' confidence is, the lower their demand for investment and the higher their liquidity preference will be. Furthermore, such behaviour is 'rational' in the presence of uncertainty.⁵⁵ To be sure, the notion that a fall in the (subjective) 'state of confidence' of economic agents is coupled to an increase in liquidity preference and a decrease in investment demand reflects the (implicit) decision of the theoretician to adopt agents' viewpoint. Secondly, there is Keynes's argument for the downward rigidity of money wages which he ascribes to the fact that workers care, mostly, about *relative* (money) wages so that they will not oppose an across-the-board decrease in *real* wages brought about by a rise in the general price level yet they will ferociously oppose attempts to cut

their *money* wages down since the latter will presumably occur in a piecemeal fashion, i.e., money wage cuts will not take place at the same time but will occur sequentially. Lastly, Keynes's important distinction between short-term and long-term expectations is, arguably, another instance of what we have denoted as 'empathic' introspection. In this case, Keynes associates short-term expectations with the level of demand for their products that entrepreneurs expect to face in the short-term, where the latter denotes the time span necessary to complete the production process. As some scholars have noted, it appears that Keynes implicitly accepted that entrepreneurs rely on simple extrapolative methods to estimate the demand for their output in the short run and that, consequently, the short-run production decisions of business firms are, in his macro-model, assumed to be endogenously-determined.⁵⁶ By contrast, he argues that long-term expectations depend on a large array of factors and, hence, he treats them as an 'exogenous' variable. Be that as it may, the key point is that Keynes's distinction between short- and long-term expectations reflects *his adopting the viewpoint of entrepreneurs* when having to make production and investment decisions respectively.

6. Summary and conclusions

We noted in Ayala & Palacio-Vera (2015) that Hume was sceptical about the rationality of human behaviour because he believed that the latter was grounded upon 'custom and habit', that is, on the assumption that the 'future will resemble the past' in spite of the inexistence of an 'inductive logic'. This paradoxical situation was denoted by Hume as the 'problem of induction'. We also presented the 'solution' proposed by Popper to the latter which we denoted as Popper's evolutionary theory of knowledge and learning (PTKL). Yet, there is a prior-to-Popper attempt to 'solve' the 'problem of induction': Keynes's (failed) attempt to provide an objective epistemological theory of probability in his *Treatise on Probability*. Keynes's aim was not only to answer Hume but also to answer Cambridge philosopher Moore (1993[1903]) who had argued that the highest expected 'good' would result if individual behaviour consists of following rules insofar as the latter represent the accumulated knowledge in a society. Keynes's proposal to solve the 'problem of induction' consists of replacing the notion of 'certain' knowledge, which Hume showed to be unattainable, by the notion of 'probabilistic' knowledge. Now, his argument was that, though we cannot attain the former, we can nevertheless attain the latter. Keynes's main innovation in the *Treatise* was the notion of 'logical probability relations'. As Andrews (1999) argues, the latter resemble Platonic

Universals in the sense that they exist in a 'logical space', are independent of individual opinions, and can only be discovered *via* intuition. Yet, the existence of 'logical probability relations' was successfully criticized by Ramsey (1978[1931]) and Keynes capitulated to Ramsey's critique in 1938 (Keynes, 1973a, p. 445) so that by the second half of the 1930s Keynes abandoned most of the ideas he had advocated in the *Treatise* and adopted a pragmatic approach to human behaviour which is remarkably similar to Hume's views. In other words, he implicitly admitted the impossibility of providing a solution to the 'problem of induction'. We showed that, in the same essay where he criticizes Keynes's *Treatise*, Ramsey (*op. cit.*) sketches a theoretical framework which is believed to have served as a benchmark for Savage's (1954) Subjective Expected Utility (SEU) theory. However, we argued that, whereas Savage's framework adopts the 'objectivist' version of Popper's *RP*, Ramsey adopts the 'subjectivist' version instead. Nevertheless, it does not seem that the framework sketched in Ramsey (*op. cit.*) inspired in any significant way Keynes's later economic writings even though it is clear he read Ramsey's essay and accepted his criticism of the *Treatise*.

Next, the view Keynes adopts in his later economic writings appears to consist of the notion that we make decisions by using inductive procedures which essentially amount to adopting the social rules and conventions which are widely believed to have yielded good results in the past. The rules and conventions Keynes identifies in his later economic writings are, for our purposes, equivalent to Hume's old idea that individual behaviour is grounded upon 'custom and habit'. In particular, the chief convention of all, according to Keynes (1937), is the assumption that 'the existing state of affairs will continue indefinitely, except in so far as we have specific reasons to expect a change' (Keynes, 1936, p. 152). We have argued that this assumption plays an essential role in Keynesian macro-theory in that it enables the theoretician to construct models in which: (i) economic agents behave in a 'rational' way in a context of genuine uncertainty, and (ii) testable predictions can *a priori* be generated.

The main purpose of this essay was to show that Keynesian macro-theory can be provided with strong epistemological foundations. In particular, we have argued that the former is essentially compatible with PTKL. Furthermore, we have also argued that the methodology underlying Keynes's macro-theory can be interpreted as an instance of the 'subjectivist' version of Popper's 'Rationality Principle' (*RPs*). As to the former case, we tried to show that the formation of both conventional expectations and confidence in Keynes's macro-theory can be viewed as the ultimate result of a complex social process

characterized by trial and error-elimination of beliefs based on conventional knowledge where those conventions that are believed by economic agents to lead to the making of wrong decisions tend to be replaced by new conventions that emerge spontaneously. In this respect, we coined the term 'hegemonic conjectures' to denote those conventions that are used by economic agents because they believe them to represent a valid guide for decision-making. The term 'hegemonic conjectures' captures two different ideas: (i) that the rules and conventions economic agents rely on resemble tentative hypotheses or conjectures in the sense that they are *provisional* and, hence, do not represent a claim to be 'true' knowledge and, (ii) that they become 'hegemonic' or widely used by economic agents through a complex social process. To the extent that the process whereby these social conventions emerge and die out is based on trial and error-elimination, we argued that the growth of conventional knowledge over time in Keynes's theory resembles the evolutionary process of expansion of knowledge in general in PTKL. In this respect, we also suggested that the evolution of conventional knowledge in Keynes's macro-theory is analogous to Kuhn's (1962) theory of scientific evolution insofar as the mechanism whereby a certain set of conventions is replaced by another one in the former exhibits a number of similarities with the mechanism whereby a scientific paradigm is superseded by another one in the latter. In particular, we believe that the role played by 'anomalies' in Kuhn's framework is similar to the role played by 'confidence' crisis in Keynes's macro-theory. As we explained, a 'confidence' crisis can be seen as taking place in the wake of the occurrence of a large observed discrepancy between expected and realized outcomes so that the social conventions that agents have been using for some time are no longer widely believed to represent a valid guide for decision-making. However, we also noted that there may be some conventions which remain 'hegemonic' indefinitely because of their simplicity and proved effectiveness. For instance, the three conventions Keynes refers to in his 1937 *Quarterly Journal of Economics* paper (Keynes, 1937) and which were the object of our discussion above are clear examples of social conventions which, to the extent that they remain in use indefinitely, provide the basis for Keynesian macro-modelling.

Next, we argued above that the convention that 'the existing state of affairs will continue indefinitely, except in so far as we have specific reasons to expect a change' is at the core of Keynesian macro-theory and is directly responsible for two criticisms the latter has frequently been subject to: (i) the alleged 'irrational' behaviour of Keynesian economic agents, and (ii) the *nihilism* of Keynesian macro-theory. Notwithstanding it,

we argued that these criticisms stem from the adoption by mainstream economists of the 'objectivist' version of Popper's 'Rationality Principle' (*RPO*). Now, we have argued in Ayala & Palacio-Vera (2015) that, in the context of neoclassical economics, the former implies that economic agents are assumed to exhibit 'substantive' rationality (i.e., to be optimizers). Furthermore, the adoption of *RPO* implies that economic agents' view of the 'problem-situation' (P-S) is assumed to *coincide* with the theoretician's. This, we argued, allows neoclassical economists to 'close' the model in a way that neat testable predictions can be derived. Yet, we argued that the 'substantive' rationality assumption presupposes that an 'inductive logic' exists that allows economic agents to acquire 'true' knowledge. Crucially, the adoption of *RPO* by neoclassical economists implies, according to us, that they assess Keynes's macro-theory under the implicit assumption that there must be a coincidence between the agents' and the theoreticians' view of P-S. Thus, for instance, if the theoretician does *not* really believe that 'the future will resemble the past' — as in Keynes's case — it follows that the construction of models where economic agents are assumed to *believe*, for practical purposes, that 'the future will resemble the past' is incoherent from the viewpoint of neoclassical theorists. Further, the charge of 'nihilism' by the latter stems from the fact that the possibility of generating testable predictions in Keynes's theory is, according to them, precluded by the fact that agents' expectations are assumed to be exogenous and, hence, to change unpredictably.

Now, we argued that the two charges alluded to above are unjustified and can be answered by showing that Keynes's theory is, unlike neoclassical theory, an instance of *RPs*. As we explained in the previous chapter, the latter implies that the theoretician seeks to reconstruct P-S not 'as she believes it is' but, rather, 'as she believes that agents believe it is'. First, the charge that Keynesian models posit economic agents who exhibit 'irrational' is related to the fact that, in Keynes's macro-theory, agents are not assumed to exhibit 'beliefs-rationality'. Yet, we argued that this is because, unlike neoclassical economists, Keynesian theoreticians (rightly) assume that there is no 'inductive logic' (i.e., 'true' knowledge cannot be attained). Besides, the adoption of *RPs* in Keynesian macro-theory implies, according to this interpretation, that though the theoretician does *not* believe that 'the future will resemble the past', she may nevertheless assume that agents believe this is the best working assumption they can make owing to the presence of genuine uncertainty in the economy. It follows that the interpretation of Keynesian macro-theory we propound implies that it is not contradictory to assume that economic

agents believe that 'the existing state of affairs will continue indefinitely, except in so far as they have specific reasons for expecting a change' even though the theoretician does *not* believe so. Likewise, if we assume that economic agents believe, for practical purposes, that the 'future will resemble the past', then Keynesian theoreticians cannot be accused of portraying economic agents' behaviour as being 'irrational' since such behaviour is *coherent* with agents' belief in the presence of a high degree of stability in the economy. Next, and according to our interpretation, Keynesian macro-theory cannot be accused of 'nihilism' either since the assumption that economic agents believe that 'the existing state of affairs will continue indefinitely, except insofar as they have specific reasons to expect a change' allows Keynesian theoreticians to construct macro-models that generate testable *predictions* (as opposed to quantitative forecasts). Some examples of these predictions as well as some examples of different parts of Keynesian macro-theory that illustrate the implicit adoption of *RPs* were provided. In short, our interpretation of Keynesian macro-theory as an instance of *RPs* is conducive to both a 'rationalization' of the typical criticisms the former is usually subject to as well as to an answer of them.

Finally, Keynesian economists tend to associate the existence of 'uncertainty' in the economy to the non-ergodic nature of the economic world. To be sure, the alleged non-ergodicity of the world is consistent with Keynes's claim — which was the basis for his criticism of Tinbergen's pioneering work on statistical inference in economics — that 'economic data is not homogeneous over time'. By contrast, we argued above that a logical implication of our interpretation of Keynesian macro-theory is that the primary cause for the existence of genuine uncertainty in the economy and its impact on agents' behaviour is not so much the absence of homogeneity through time of economic data and, hence, the alleged impossibility of extrapolating the past into the future, but *the absence of an 'inductive logic'*. In other words, 'uncertainty' is ultimately implied by Popper's claim that all knowledge is *conjectural* and, hence, provisional. Consequently, even if economic data appears to be homogeneous through a long period of time, this is by no means a proof that the former will remain homogeneous in the future. That is, in the absence of an 'inductive logic' it cannot be shown that 'the future will resemble the past'. Such claim is *conjectural*. This suggests that the relevance of the notion of non-ergodicity for Keynesian macro-theory is, according to us, overemphasised insofar as an even more substantial reason for the existence of uncertainty is the *conjectural* nature of human knowledge.

References

- Andrews, D. R. (1999) Continuity and change in Keynes's thought: the importance of Hume, *European Journal of the History of Economic Thought*, 6(1), pp. 1-21.
- Arrow, K.J. (1986) Rationality of Self and Others in an Economic System, *Journal of Business*, 59(4), pp. S385-99.
- Ayala, I. H. & Palacio-Vera, A. (2015) Some Reflections on Popper's Approach to Rationality and its Implications for the Social Sciences, Working Paper no. 1503, March, *School of Economics and Business, Universidad Complutense de Madrid*, Spain.
- Bateman, B. W. (1987) Keynes's Changing Conception of Probability, *Economics & Philosophy*, 3(1), pp. 97-120.
- Bateman, B. W. (1988) G. E. Moore & J. M. Keynes: A Missing Chapter in the History of the Expected Utility Model, *American Economic Review*, 78(5), pp. 1098-1106.
- Bateman, B. W. (1990) Keynes, induction, & econometrics, *History of Political Economy*, 22(2), pp. 359-379.
- Bateman, B. W. (1991) Das Maynard Keynes Problem, *Cambridge Journal of Economics*, 1(15), pp. 101-111.
- Becker, G. (1962) Irrational behavior and economic theory, *Journal of Political Economy*, 70(1), pp. 1-13.
- Beinhocker, E. D. (2013) Reflexivity, complexity, and the nature of social science, *Journal of Economic Methodology*, 20(4), pp. 330-342.
- Brown-Collier, E. & Bausor, R. (1988) The Epistemological Foundations of the General Theory, *Scottish Journal of Political Economy*, 35(3), pp. 227-241.
- Carabelli, A. M. (1988) *On Keynes's Method*, London: Macmillan.
- Carnap, R. (1950) *Logical Foundations of Probability*, Chicago: University of Chicago Press.
- Carvalho, F. (1988) Keynes on probability, uncertainty, and decision making, *Journal of Post Keynesian Economics*, 11(1), pp. 66-80.
- Choi, Y. B. (1993) *Paradigms and Conventions. Uncertainty, Decision Making, and Entrepreneurship*, Michigan: University of Michigan.
- Coddington, A. (1976) Keynesian Economics: The Search for First Principles, *Journal of Economic Literature*, 14(4), pp. 1258-1273.
- Coddington, A. (1982) Deficient Foresight: A Troublesome Theme in Keynesian Economics, *American Economic Review*, 72(3), pp. 480-487.

- Cottrell, A. (1993) Keynes's Theory of Probability and its Relevance to his Economics. Three Theses, *Economics & Philosophy*, 9(1), pp. 25-51.
- Crotty, J. R. (1980) Post-Keynesian Economic Theory: An Overview and Evaluation, *American Economic Review*, Papers and Proceedings, 70(2), pp. 20-25.
- Crotty, J. R. (1990) Keynes on the Stages of Development of the Capitalist Economy: The Institutional Foundations of Keynes's Methodology, *Journal of Economic Issues*, 24(3), pp. 761-780.
- Crotty, J. R. (1994) Are Keynesian Uncertainty and Macrotheory Compatible? Conventional Decision Making, Institutional Structures, and Conditional Stability in Keynesian Macromodels, in G. Dymski & R. Pollin (eds.), *New Perspectives in Monetary Macroeconomics*, pp. 105-139, Ann Arbor: University of Michigan Press.
- Davidson, P. (1991) Is Probability Theory Relevant for Uncertainty? A Post Keynesian Perspective, *Journal of Economic Perspectives*, 5(1), pp. 129-143.
- Davis, J. B. (1989-90) Keynes & Organicism: Comment, *Journal of Post Keynesian Economics*, 12(2), pp. 308-315.
- Davis, J. B. (1994) *Keynes's Philosophical Development*, Cambridge: Cambridge University Press.
- Davis, J. B. (1997) J. M. Keynes on History and Convention, in Harcourt, G. C. and Riach, P. A. (eds.) *A 'Second Edition' of The General Theory*, Vol. 2, pp. 203-221, London: Routledge.
- De Finetti, B. (1937) Foresight: Its Logical Laws, Its subjective Sources, *Annales de l'Institut Henri Poincaré*, vol. 7, reproduced in Kyburg, H. E. & Smokler, H. E. (eds.) *Studies in Subjective Probability*, pp. 93-158, 1967, New York: John Willey & Sons.
- Dow, S. C. (1995) The appeal of neoclassical economics: some insights from Keynes's epistemology, *Cambridge Journal of Economics*, 19(6), pp. 715-733.
- Dow, S. C. (2009) David Hume & Modern Economics, *Capitalism & Society*, 4(1), Article 1.
- Dow, A. & Dow, S. C. (2011) Animal Spirits Revisited, *Capitalism & Society*, 6(2), Article 1.
- Eichner, A. S. & Kregel, J. A. (1975) An Essay on Post-Keynesian Theory: A New Paradigm in Economics, *Journal of Economic Literature*, 13(4), pp. 1293-1314.
- Festinger, L. (1957) *A theory of cognitive dissonance*, Standford, California: University of Standford.
- Fitzgibbon, A. (1988) *Keynes's vision: a new political economy*, Oxford (UK): Clarendon Press.

- Gillies, D. (2000) *Philosophical Theories of Probability*, Routledge: London.
- Hamlin, A. P (1986) *Ethics, Economics and the State*, New York: St. Martin's Press. Reprinted in Caldwell, B. (ed.), 1993, *The Philosophy and Methodology of Economics I*, pp. 304-362, Aldershot: Edward Elgar.
- Hamouda, O. F. & Harcourt, G. C. (1988) Post Keynesianism: From Criticism to Coherence, *Bulletin of Economic Research*, 40(1), pp. 1-33.
- Hamouda, O. & Smithin, J. (1988) Some Remarks on 'Uncertainty and Economic Analysis', *Economic Journal*, 98(389), March, pp. 159-164.
- Hayek, F. A. (1942) Scientism and the Study of Society. Part I, *Economica*, 9(35), pp. 267-291.
- Hayek, F. A. (1943a) The Facts of the Social Sciences, *Ethics*, 54(1), pp. 1-13.
- Hayek, F. A. (1943b) Scientism and the Study of Society. Part II, *Economica*, 10 (37), pp. 34-63.
- Hayek, F. A. (1967) Degrees of Explanation, in *Studies in Philosophy, Politics & Economics*, pp. 3-21, Chicago: University of Chicago Press.
- Heiner, R. A. (1983) The Origin of Predictable Behavior, *American Economic Review*, 73(4), pp. 560-595.
- Hempel, G. C. (1949) The Function of General Laws in History, in H. Feigl & W. Sellars (eds.) *Readings in Philosophical Analysis*, pp. 462-5, New York: Appleton-Century-Crofts .
- Hicks, J. R. (1974) *The Crisis in Keynesian Economics*, Oxford: Basil Blackwell.
- Hicks, J. R. (1979) *Causality in Economics*, New York: Basic Books.
- Howitt, P. (1997) Expectations and Uncertainty in Contemporary Keynesian Models, in Harcourt, G. C. & Riach, P. A. (eds.) *A 'Second Edition' of The General Theory*, Vol. 1, pp. 238-260, London: Routledge.
- Hume, D. (1978[1739-40]) *A Treatise of Human Nature*, Oxford: Clarendon Press.
- Hume, D. (2006[1748]) *An enquiry concerning human understanding: a critical edition*, Oxford, Clarendon Press; New York: Oxford University Press.
- Iwai, K. (2009) The Second End of Laissez Faire — Bootstrapping Nature of Money and Inherent Nature of Capitalism, *CIRJE-F-646 Discussion Paper*, August, University of Tokyo.
- Jeffreys, H. (1939) *Theory of Probability*, Oxford: Oxford University Press.

Kakarot-Handtke, E. (2012) Why Post Keynesianism is not yet a science, Working Paper, *University of Stuttgart, Institute of Economics and Law*, September.

Keynes, J. M. (1920) *A Treatise on Probability*, London: Macmillan.

Keynes, J. M. (1936) *The General Theory of Employment, Interest and Money*. Cambridge: Macmillan.

Keynes, J. M. (1937) The General Theory of Employment, *Quarterly Journal of Economics*, 51(2), pp. 209–223.

Keynes, J. M. (1973a) The General Theory and After: A Supplement, *The Collected Writings of John Maynard Keynes*, vol. XXIX, pp. 293-94, London: Macmillan.

Keynes, J. M. (1973b) Essays in Biography, *The Collected Writings of John Maynard Keynes*, vol. X, London: Macmillan.

Klant, J. (1985) The Slippery Transition, in T. Lawson & H. Pesaran (eds.) *Keynes's Economics*, London: Croon Helm.

Knight, F. H. (1971[1921]) *Risk, Uncertainty, and Profit*, Chicago: The University of Chicago Press.

Kuhn, T. (1962) *The Structure of Scientific Revolutions*, Chicago: The University of Chicago Press.

Lavoie, M. (2014) *Post-Keynesian economics: new foundations*, Northampton (MA): Edward Elgar.

Lawson, T. (1985) Uncertainty and Economic Analysis, *Economic Journal*, 95(380), pp. 909-927.

Lawson, T. (1987) The Relative/Absolute Nature of Knowledge and Economic Analysis, *Economic Journal*, 97(388), pp. 951-970.

Lawson, T. (1988) Probability and uncertainty in economic analysis, *Journal of Post Keynesian Economics*, 11(1), pp. 38-65.

Littleboy, B. (1990) *On Interpreting Keynes: A Study in Reconciliation*, London: Routledge.

Moore, G. E. (1912) *Ethics*, New York: Henry Holt.

Moore, G.E (1993[1903]), *Principia Ethica*, Cambridge: Cambridge University Press.

Notturmo, M. A. (1998) Truth, Rationality, and the Situation, *Philosophy of the Social Sciences*, 28(3), pp. 400-421.

O'Donnell, R. (1990) An overview of probability, expectations, uncertainty and rationality in Keynes's conceptual framework, *Review of Political Economy*, 2(3), pp. 253-66.

- Papandreou, A. G. (1959) Explanation and Prediction in Economics, *Science*, 129, April, pp. 1096-1100.
- Popper, K. R. (1959) The Propensity Interpretation of Probability, *British Journal for the Philosophy of Science*, 10 (37), pp. 25-42.
- Popper, K. R. (1990) *A World of Propensities*, Bristol (UK): Thoemmes.
- Popper, K. R. (1994) *The Myth of the Framework: In defence of science and rationality*, London: Routledge.
- Ramsey, F. P. (1978[1931]) 'Truth and probability', in *Foundations: Essays in Philosophy, Logic, Mathematics & Economics*, pp. 58-100, edited by D. H. Mellor, London: Routledge & Kegan Paul.
- Robbins, L. (1932) *An Essay on the Nature and Significance of Economic Science*, London: Macmillan. Reprinted in D. M. Hausman (ed.) 1984, *The Philosophy of Economics: An anthology*, pp. 113-140, Cambridge: Cambridge University Press.
- Rotheim, R. J. (1989-90) Organicism and the role of the individual in Keynes: Comment, *Journal of Post Keynesian Economics*, 12(2), pp. 316-326
- Runde, J. (1990) Keynesian Uncertainty and the Weight of Arguments, *Economics and Philosophy*, 6(2), pp. 275-292.
- Runde, J. (1997) Keynesian Methodology, in Harcourt, G. C. & Riach, P. A. (eds.) *A 'Second Edition' of The General Theory*, Vol. 2, pp. 222-243, London: Routledge.
- Runde, J. (1998) Clarifying Frank Knight's discussion of the meaning of risk and uncertainty, *Cambridge Journal of Economics*, 22(5), pp. 539-546.
- Rutherford, M. C. (1984) Rational expectations and Keynesian uncertainty: a critique, *Journal of Post Keynesian Economics*, 6(3), pp. 377-387.
- Samuelson, P. A. (1969) Classical and Neoclassical Theory, in Clower, R. W. (ed.), *Monetary Theory*, London: Penguin.
- Savage, L. (1954) *The Foundations of Statistics*, New York: Wiley.
- Schumpeter, J. A. (1984) The Meaning of Rationality in the Social Sciences, *Journal of Institutional and Theoretical Economics*, 140(4), pp. 577-593.
- Shackle, G. L. S. (1984) Comment on the papers by Randall Bausor & Malcolm Rutherford, *Journal of Post Keynesian Economics*, 6(3), pp. 388-393.
- Simon, H. A. (1976) From Substantive to Procedural Rationality, in Spiro J. Latsis (ed.) *Method and Appraisal in Economics*, pp.129-148, Cambridge: Cambridge University Press.

- Solow, R. M. (1985) Economic History and Economics, *American Economic Review*, Papers and Proceedings, 75(2), pp. 328-31.
- Tarshis, L. (1980) Post-Keynesian Economics: A Promise that Bounced? *American Economic Review*, Papers and Proceedings, 70(2), pp. 10-28.
- Veblen, T. B. (1924[1899]) *The Theory of the Leisure Class*, London: George Allen & Unwin.
- von Mises, L. (1928) *Probability, Statistics & Truth*, 2nd revised English edition, Allen & Unwin.
- von Mises, L. (1944) The Treatment of “Irrationality” in the Social Sciences, *Philosophy and Phenomenology Research*, 4(4), pp. 527-546.
- von Neumann, J. & Morgenstern, O. (1947) *Theory of Games and Economic Behaviour*, Princeton (NJ): Princeton University Press.
- Walters, B. & Young, D. (1997) On the Coherence of Post-Keynesian Economics, *Scottish Journal of Political Economy*, 44(3), pp. 329-49.
- Watkins, J. W. N. (1952) Ideal Types and Historical Explanation, *British Journal for the Philosophy of Science*, 3(9), pp. 22-43.
- Whitehead, A. N. & Russell, B. (1925) *Principia Mathematica*, 2nd edition, Cambridge: Cambridge University Press.
- Winslow, E. G. (1986) Human logic and Keynes’s economics, *Eastern Economic Journal*, 12(4), pp. 413-30.
- Winslow, E. G. (1989) Organic Interdependence, Uncertainty & Economic Analysis, *Economic Journal*, 99(398), pp. 1173-1182.
- Yellen, J. L. (1980) On Keynesian Economics & the Economics of the Post-Keynesians, *American Economic Review*, Papers and Proceedings, 70(2), pp. 15-19.

¹ These two criticisms do appear, in different forms, in most of the critical surveys of Post-Keynesian (PK) economics which have been published over the last decades. Some examples are Coddington (1976, 1982), Yellen (1980), Tarshis (1980), Walters & Young (1997), and Kakarot-Handtke (2012). In turn, the responses of PK economists to these criticisms are, for instance, in Eichner & Kregel (1975), Hamouda & Harcourt (1988), Crotty (1980, 1994), and Lavoie (2014).

² In turn, this was based on Moore’s conception of the real existence of non-natural (or non-physical) entities which Keynes took on board when developing his theory of probability in the *Treatise*. The belief in the real existence of such non-physical entities is known as Platonism. As noted in Bateman (1991, p. 105), ‘Moore believed in good, and Keynes in probabilities, in exactly the same sense as Plato believed in universal ideal forms’.

³ This is explained by Keynes as follows:

‘... in the sense important to logic, probability is not subjective. It is not, that is to say, subject to human caprice. A proposition is not probable because we think it so. 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 of our opinion. The Theory of Probability is logical, therefore, because it is concerned with the degree of belief which it is *rational* to entertain in given conditions' (Keynes, 1920, p. 4).

⁴ In a similar vein, Dow (2009, p. 14) points out that Keynes's *Treatise* addressed the same question that Hume raised with his 'problem of induction'.

⁵ Carabelli (1988) uses the term 'ordinary logic' to refer to 'human logic' whereas Winslow (1986) uses the latter term which was originally coined by Ramsey (1978[1931]).

⁶ According to Lawson (1985), Carvalho (1988), Carabelli (1988) and O'Donnell (1990) this shift did not require a significant change in his basic theoretical framework, however. By contrast, Andrews (1999), Bateman (1987, 1990, 1991) and Davis (1994) hold the opposite thesis.

⁷ Similarly, Gillies (2000) has recently propounded an inter-subjective interpretation of probability as an additional version of the subjective epistemological interpretation of probability.

⁸ Popper (1990, p. 12) makes it clear that statistical averages will exhibit a tendency to remain stable *only* if the physical conditions remain stable. He makes this phenomenon the basis of his 'propensity theory of probability' (Popper, 1959) which is an *objective* interpretation of the theory of probability. Popper (1990, p. 8) associates the subjectivist theory of probability in the field of physics to Heisenberg and Einstein but he makes clear that he adopts an *objectivist* theory. According to this interpretation, propensities are real forces that stem from physical realities. What is even more important, he recognizes that in our changing real world propensities change *all the time*:

'With the introduction of propensities, the ideology of determinism evaporates. Past situations, whether physical or psychological or mixed, do not determine the future situation. Rather, they determine changing *propensities that influence future situations without determining them in a unique way*... Quite apart from the fact that we do not know the future, the future is *objectively not fixed*. The future is *open: objectively open*' (*op. cit.*, pp. 17-18).

⁹ It could be argued that it is the absence of ends-rationality that prevents the notion of logical probability relations from providing a full-fledged theory of human behaviour.

¹⁰ According to O'Donnell (1990), the picture that emerges from Keynes's analysis in the *General Theory* is also of a 'two-dimensional' and 'two-domain' type of analysis. The two dimensions are expectations and confidence whereas the two domains are *short-term* and *long-term expectations* (O'Donnell, 1990, p. 260). In the first domain, short-term expectations are typified by uncertainty in the context of relatively high weight and confidence whereas, in the second domain, long-term expectations are characterised by uncertainty coupled to either high or low confidence depending upon the situation. The expectations-confidence pair in the *General Theory* is, according to O'Donnell (*op. cit.*), a generalized version of the probability-weight pair in the *Treatise*. This leads him (*op. cit.*, p. 263) to contend that Keynes advanced a pioneering *theory of rationality under radical uncertainty* consisting of two independent dimensions with economic agents forming expectations about outcomes and degrees of confidence about the latter.

¹¹ O'Donnell (1990, p. 259) notes that the 'continuity vs. change' issue in Keynes' philosophical views after 1921 has led to a division of opinion. On the one hand, there are those like Winslow (1986, 1989) or Davis (1994) who argue that in 1932, and under the strong impact of Ramsey's (1978 [1931]) criticism of Keynes's later views, Keynes switched to a non-logical theory of probability. In a similar vein, Shackle (1984, p. 391) writes that 'Keynes the economist abandoned probability in any technical form... Keynes's probability theorizing has no overt bearing on the economics which he published'. On the other hand, there are those like Lawson (1985), Rutherford (1984, p. 381), or Carvalho (1988, p. 72) who argue that Keynes did not adopt an alternative conception of probability but rather continued to work within the theoretical framework of the *Treatise on Probability*. Other authors adopt a middle-ground position. For instance, O'Donnell (*op. cit.*) argues that Keynes's thought continued to be grounded on the conceptual framework of the *Treatise* albeit there was an internal change of emphasis within his framework after 1932 which consisted of an increase in the relative significance of the 'indeterminate' domain and 'weak' rationality. Likewise, Runde (1997, p. 241) maintains that, in his later work, Keynes gave up his ontology

of logical probability relations albeit he continued to regard qualitative probability comparisons as basic to epistemic probability.

¹² In this respect, Andrews (1999, p. 10) argues that these two notions have outlasted other elements of the *Treatise* because they are not crucial to its central argument. As we show below, its central argument was rejected by Keynes in the wake of Ramsey's critique of it.

¹³ According to Runde (1990), the dichotomy between probability and confidence (and weight) can also be extended over to Keynes's distinction between 'risk' and 'liquidity' premium alluded to in a letter addressed to Townshend and written after the publication of the *General Theory*:

'I am rather inclined to associate risk premium with probability strictly speaking, and liquidity premium with what in my *Treatise on Probability* I called "weight". An essential distinction is that a risk premium is expected to be rewarded on the average by an increased return at the end of the period. A liquidity premium, on the other hand, is not even expected to be so rewarded. It is a payment, not for the expectation of increased tangible income at the end of the period, but for an increased sense of comfort and confidence during the period' (Keynes, 1973a, reproduced in Runde, 1990).

Be that as it may, a reading of Keynes' writings suggests that he does not view 'confidence' and 'weight' as being interchangeable albeit he would probably concede that they tend to move in the same direction in which case the appropriate conception of weight is 'some [subjective] measure of the degree of completeness of the information on which a decision is based' (Runde, 1990, p. 287). Thus, if we take expression (2) above as the most adequate interpretation of the notion of weight, then the greater the weight of evidence in favour of a certain forecast the more robust the basis on which to formulate it and, hence, the more confident we will be that our forecast is an appropriate guide to action.

¹⁴ The notion of 'weight of the argument' also appears in the *General Theory* in the context of Keynes' discussion of investment decision-making.

¹⁵ However, Rutherford (1984, p. 379-80) argues that 'Keynes contended that even a large quantity of favourable evidence could not logically impart a high probability to a hypothesis if the evidence emanated from repetitions of *identical* experiments or observations made under *identical* conditions' (Keynes, 1920, pp. 217-219). According to him, it follows from this that a certain amount of evidence will mean more (less) if it is collected under varied (similar) conditions.

¹⁶ For instance, Dow (1995, p. 726) points out that, according to Keynes, 'more weight [should] be given to facts of which we are more certain than to facts of which we are very uncertain even if they are more relevant to the argument'.

¹⁷ Similarly, Dow & Dow (2011, pp. 6-7) argue that 'the degree to which ignorance is recognised is ultimately a matter of psychology' and, hence, they implicitly suggest that the 'weight of an argument' is subjective.

¹⁸ In particular, and referring to the notion of 'weight', Keynes writes that 'the question to be raised in this chapter is somewhat novel; after much consideration I remain uncertain as to how much importance to attach to it' (Keynes, 1920, p. 71).

¹⁹ Keynes alludes to 'weight' in the *General Theory* (1936, p. 148) and in a letter to Townshend written in 1938 (Keynes, 1973b, p. 293) where Keynes relates 'weight' to the notion of 'liquidity premium'. In the *General Theory*, Keynes gives it an explanatory role in three different areas: uncertainty, confidence, and liquidity preference. Specifically, 'weight' exerts two effects on the current level of investment. First, it influences the marginal efficiency of capital through its impact on the level of confidence. Second, it influences the rate of interest through its relation to liquidity preference.

²⁰ Savage's theory builds upon the work of both Ramsey (1978[1931]) and De Finetti (1937) who showed that subjective probability could be defined in terms of preferences over gambles and of von Neumann and Morgenstern (1947) who provided the first axiomatic derivation of expected utility theory. Another example is Ramsey's optimal growth model (Ramsey, 1978[1931], ch. 11) which represents the standard approach to analysing optimal growth in macroeconomics.

²¹ Likewise, in his critique of Keynes's notion of *a priori* probability relations, Ramsey (1978[1931]), p. 94) suggests that *a priori* probabilities would be 'determined by natural selection'. However, it has been suggested that one of the reasons Keynes failed to provide an alternative to the frequency approach to probability in the *Treatise* was that 'he made use of an epistemology of intuition that lacked a theory of error' (Davis, 1994, p. 102). We argue below that Keynes adopted in his later economic writings a theory of human behaviour based on conventional judgement which can, in turn, be provided with a trial and error-elimination mechanism in a way that makes the former compatible with evolutionary epistemology.

²² However, Ramsey's notion of 'human logic' implies, according to Keynes, more than mere consistency of thought:

'[Ramsey] was led to consider "human logic" as distinguished from "formal logic". Formal logic is concerned with nothing but the rules of consistent thought. But in addition to this we have certain "useful mental habits" for handling the material with which we are supplied by our perceptions and by our memory and perhaps in other ways, and so arriving at or towards truth; and the analysis of such habits is also a sort of logic' (Keynes, 1973*a*, p. 338)

²³ See, for instance, Winslow (1989, p. 1178).

²⁴ Keynes implicitly accepted the validity of the frequency approach to probability in the natural sciences in a letter addressed to Harrod on 4th July 1938 the full content of which is shown in a footnote below.

²⁵ This may become clear after reading a fragment of the discussion where he introduces his framework:

'Let us give an instance of the sort of case which might occur. I am at a cross-roads and do not know the way; but I rather think one of the two ways is right. I propose therefore to go that way but keep my eyes open for someone to ask; if now I see someone half a mile away over the fields, whether I turn aside to ask him will depend on the relative inconvenience of going out of my way to cross the fields or of continuing on the wrong road if it is the wrong road. But it will also depend on *how confident I am that I am right*; and clearly the more confident I am of this the less distance I should be willing to go from the road to check my opinion. I propose therefore to use the distance I would be prepared to go to ask, as a measure of the confidence of my opinion...' (Ramsey, 1978[1931], pp. 76-77, emphasis added).

Indeed, Ramsey's notion of 'degree of belief' is precisely the *measure* of the confidence of one's opinion and is, thus, subjective. In any case, the paragraph highlights that the distance I am willing to go out of my way to check my opinion is also the maximum distance I *should be willing* to go out of my way to check my opinion if I really wished to realize the objects of my desire. We believe the example shows that *Ramsey's framework is an example of RPs* in that 'the theoretician reconstructs P-S as she believes the agent believes it is'.

²⁶ This is nicely explained in Davis (1994):

'In Keynes's later career, then the effort to explain the operation of the economic world produced a change in philosophical thinking that forced abandonment, modification, and replacement of much that Keynes had previously believed. Intuition in the Moorean sense was replaced by individual expectation. The focus on probability became secondary to the focus on convention. Rational behaviour as a principal concern in the analysis of individual judgement was supplanted by a preoccupation with the effects of interdependence and uncertainty... Unfortunately, Keynes never clearly articulated his philosophical conversion, largely no doubt on account of the tremendous demands upon his time made by economics and policy' (Davis, 1994, pp. 146-7).

²⁷ Choi (1993, pp. 63-66) provides some insightful ideas stemming from psychology which enhance the Keynesian argument that economic agents rely on conventional 'rules of thumb' when making decisions. For instance, he argues that our confidence in the way we do things tends to be reinforced by the approval of others as well as by our belief that our own behaviour merits the applause of others.

²⁸ Runde (1997, p. 228) argues that should Keynes have written a ‘second edition’ of the *General Theory* he would have elaborated on the theme of conventional methods of expectations formation as surrogates for mathematical calculus and the way in which such methods contribute to financial market instability.

²⁹ Keynes’s insight is eloquently put in Iwai (2009, p. 8, emphasis added):

‘In the end, the only reason a particular face is selected as the prettiest is that every competitor [in the Beauty Contest] believes every other competitor believes she is selected as the prettiest, without any support from reality, either objective or subjective. *The prettiest is the prettiest merely because she is selected as the prettiest.* What we see here is the working of the “bootstrapping” logic of Baron Münchhausen who claimed he had pulled himself out of a swamp by pulling on his own bootstraps’.

³⁰ For instance, Littleboy (1990, p. 29) argues that ‘one of Keynes’s most important innovations lay in the realization of the significance of conventions that arise when transactors, confronted by an uncertain environment, are psychologically disposed to act in a manner in which they study and imitate the actions of others’. He advances a theory of macroeconomic dynamics grounded on the interaction of different conventions in different spheres of the economic system (*op. cit.*, pp. 289ff).

³¹ Davis (1997) argues that the theory of the formation of social conventions in Keynes’ theory remains undeveloped. For instance, he notes the *interactive* character of the formation of conventional judgements and suggests that in a hypothetical ‘second edition’ of the *General Theory* Keynes would have focused on the interaction between individual and average opinion and on how confidence varies according to the degree of coincidence between them. He discusses several hypothetical scenarios where, depending on the degree of coincidence between individual and *average* opinion, the ‘shared’ degree of confidence may either vary or remain stable (*op. cit.*, pp. 216-17). However, he does not see an evolutionary dimension in Keynes’s approach to the formation of conventions albeit he writes that ‘for Keynes, then, the conditions associated with states of confidence concern the success or lack of success with which individuals come to assess each other’s opinions about markets’ (*op. cit.*, p. 217). Notwithstanding it, Howitt (1997, p. 241) points out that it would have been natural for Keynesian economics to follow the approach suggested by behavioural or evolutionary economics in the study of the causal mechanisms underlying the formation of conventional expectations.

³² Similarly, as noted in Lawson (1985, p. 918), the notion of rationality that stems from Keynes’s macro-theory is compatible with Simon’s notion of ‘bounded’ rationality.

³³ Arguably, it may not be possible for some individuals to observe *directly* how successful other people have been in the past and, further, the success or lack of it of the latter may not be a direct outcome of the adoption by some people of particular beliefs. As to the former issue, some people may assume that those who have a higher social status have adopted beliefs which tend to be correct on average as in Veblen’s theory of social emulation (Veblen, 1924[1899]). As to the second issue, we need to assume that success is *mainly* associated to the holding of ‘correct’ beliefs.

³⁴ In this account of Keynes’s macro-theory there is, arguably, very little scope for ‘irrational’ behaviour. In some interpretations of the former, ‘irrationality’ is usually associated to the notion of ‘animal spirits’. However, as Dow & Dow (2011, p. 7) note, Keynes recognised that ‘animal spirits’ is less relevant to decision-making than conventional judgement, at least in the context of financial markets. Keynes uses the term ‘animal spirits’ three times in chapter 12 of the *General Theory* where he refers to the decision by entrepreneurs to invest in real capital:

‘Most, probably, of our decisions to do something positive, the full consequences of which will be drawn out over many days to come, can only be taken as a result of *animal spirits* — of a spontaneous urge to action rather than inaction, and not as the outcome of a weighted average of quantitative benefits multiplied by quantitative probabilities... Thus if the *animal spirits* are dimmed and the spontaneous optimism falters, leaving us to depend on nothing but a mathematical expectation, enterprise will fade and die... But individual initiative will only be adequate when reasonable calculation is supplemented and supported by *animal spirits*, so that the thought of ultimate loss which often overtakes pioneers, as experience undoubtedly tells us and them, is put aside as a healthy man puts aside the expectation of death’ (Keynes, 1936, pp. 161-62, emphasis added).

We thus believe that ‘animal spirits’ plays a marginal role in Keynes’s theory. To us, the role of ‘animal spirits’ in Keynes’s theory is similar to Hume’s idea that the ultimate driver of human action is not reason but sentiment or passion or as he puts it: ‘I shall endeavour to prove first, that reason alone can never be a motive to any action of the will; and secondly, that it can never oppose passion in the direction of the will’ (Hume, 1978[1739-40], p. 413). In terms of the conceptual framework used in the previous chapter, ‘animal spirits’ may only amount to (unconscious) aims of individuals and, as such, it has to be taken as given for the purpose of macroeconomic analysis. In the context of Popper’s *SA*, ‘animal spirits’ represent an exogenous element in the ‘problem-situation’ individuals find themselves. Be that as it may, we believe there is very little explanatory and predictive power we can gain by focusing on the role of ‘animal spirits’ and, hence, that a more promising avenue for research in macroeconomics is to study the conventional basis of economic behaviour.

³⁵ In this respect, Runde (1997) argues that, in chapter 12 of the *General Theory*, Keynes elaborates on the theme of conventional methods of calculation as surrogates for mathematical calculation and the ways through which conventional behaviour may lead to financial instability. He then conjectures that Keynes would have reinforced this part of his argument had there been a ‘second edition’ of *The General Theory*.

³⁶ However, some HC may withstand the passing of time if people keep on believing that they represent useful guides for behaviour. The three conventions Keynes (1937, pp. 214-15) refers to and which were listed above are examples of HC which have successfully withstood the passing of time.

³⁷ Incidentally, when referring to the notion of ‘sunspot’ equilibria in neoclassical theory, Arrow (1986) points out that the former refers to the existence of a continuum of equilibria in which one equilibrium is based on fundamentals and the remaining equilibria depend on the contingency that becomes relevant simply because everyone *believes* it is relevant. He adds that, in such cases ‘we can have situations where social truth is essentially a matter of *convention*, not of underlying realities’ (Arrow, 1986, p. S396, emphasis added).

³⁸ In particular, and in addition to the issue we address in this section and which concerns the alleged non-homogeneity of economic material over time, Keynes also raises in those letters several issues related to the problem of omitted variables, lag lengths, and model specification in his correspondence with Harrod and Tinbergen.

³⁹ As Davis (1994, p. 144) writes, ‘that the future is not a function of “past statistics” and that one must always leave some room for “expectation and the state of confidence relating to the future” suggests that Keynes did not believe that there was much scope for inductive methods in economics’. Likewise, Nobel Laureate in Economics John Hicks declares that ‘I am bold enough to conclude from these considerations that the usefulness of “statistical” or “stochastic” methods in economics is a good deal less than is now conventionally supposed’ (Hicks, 1979, p. 129).

⁴⁰ We reproduce the letters below. The first letter addressed to Harrod was issued on 4th July 1938:

‘It seems to me that economics is a branch of logic, a way of thinking; and that you do not repel sufficiently firmly attempts à la Schultz to turn it into a pseudo-natural science. One can make quite worthwhile progress merely by using your axioms and maxims. But one cannot get very far except by devising new and improved models. This requires, as you say, “a vigilant observation of the actual working of our system”. *Progress* in economics consists almost entirely in a progressive improvement in the choice of models... But it is of the essence of a model that one does *not* fill in real values for the variable functions. To do so would make it useless as a model. For as soon as this is done, the model loses its generality and its value as a mode of thought... The object of statistical study is not so much to fill in missing variables with a view to prediction, as to test the relevance and validity of the model... Economics is a science of thinking in terms of models joined to the art of choosing models which are relevant to the contemporary world. It is compelled to be this, because, unlike the typical natural science, the material to which it is applied is, in too many respects, not homogeneous through time. The object of a model is to segregate the semi-permanent or relatively constant factors from those which are transitorily or fluctuating so as to develop a logical way of thinking about the latter, and of understanding the time sequences to which they give rise in particular cases... Good economists are scarce because the gift for using “vigilant observation” to choose good models, although it does not require a highly specialised intellectual technique, appears to be a very rare one’ (Keynes, 1973*b*, pp. 295-7).

The second letter addressed to Harrod was issued on 16th July 1938:

‘The point needs emphasising because the art of thinking in terms of models is a difficult — largely because it is an unaccustomed — practice. The pseudo-analogy with the physical sciences leads directly counter to the habit of mind which is most important for an economist proper to acquire. I also want to emphasise strongly the point about economics being a moral science. I mentioned before that it deals with *introspection and with values. I might have added that it deals with motives, expectations, psychological uncertainties*. One has to be constantly on guard against treating the material as constant and homogeneous. It is as though the fall of the apple to the ground depended on the apple’s motives, on whether it is worth while falling to the ground, and whether the ground wanted the apple to fall, and on mistaken calculations on the part of the apple as to how far it was from the centre of the earth’ (Keynes, 1973a, pp. 299-300, emphasis added).

⁴¹ Although Popper apparently borrowed the terms ‘explanation in principle’ and ‘explanation in detail’ from Hayek (1967), to the best of our knowledge, these terms are mentioned for the first time in Watkins (1952).

⁴² A classic discussion of this topic in the context of economics is in Papandreou (1959). He argues that (i) economists construct models rather than theories, and (ii) economic models are *strictly explanatory devices*. More precisely, he argues that economic models cannot be used as predictive devices because the conditions of their applicability cannot be set out in advance (*op. cit.*, p. 1099).

⁴³ In the literature on Keynesian economics, the non-homogeneity of economic data is usually associated to the mathematical notion of non-ergodicity. According to Davidson (1996, p. 479), most mainstream economists implicitly assume the existence of a predetermined, immutable or ergodic world that can be fully described by objective conditional probability distributions. He identifies three different decision-making economic environments: (i) the objective probability environment, (ii) the subjective probability environment, and (iii) the *truly* uncertain environment (Davidson, 1991). In the objective probability environment, the realm of the ‘rational expectations hypothesis’ (REH), decision-makers believe that the past is a statistically *unbiased* guide to the future. As Davidson explains, for the REH to provide a theory of expectations formation, not only must the subjective and objective probability distribution functions coincide at any point in time but they must also be derived from ‘ergodic’ stochastic processes. The latter exhibit the key property that ‘averages calculated from past observations cannot be persistently different from the time average of future outcomes’ (*op. cit.*, p. 132). Non-ergodicity is sometimes likened to non-stationarity. However, as Davidson (*op. cit.*) makes clear, non-stationarity is a sufficient, but not necessary condition, for non-ergodicity.

⁴⁴ More specifically, Robbins argues that the ultimate premises of social science are human dispositions. As he explains, such dispositions ‘are so much the stuff of our everyday experience that they have only to be stated to be recognised as obvious’ (Robbins, 1932, p. 79).

⁴⁵ Notwithstanding it, this is not necessarily the case in practice. For instance, Heiner (1983, p. 561) notes that (neoclassical) optimization models are unable to imply the ‘Law of Demand’ (i.e., that an increase in the relative price of a commodity will lead to a decrease in its demand) which is, arguably, the simplest empirical regularity in economics. He notes that we can certainly use neoclassical consumer theory to argue that it is *unlikely* that a negative income effect will outweigh the substitution effect yet we cannot be sure that this will be the case. Notably, he comments the following:

‘I was told in a graduate price-theory class by Armen Alchian that the only clear implication of consumer theory is that with more income, a consumer will buy more of at least something. Harold Demsetz, when informed of this story, responded by saying, “well then just define holding cash balances as saving, and we have no testable implications, just one mass of tautologies”’ (*op. cit.*, footnote 4).

⁴⁶ Of course, this presupposes that the statistical environment is stable. As we have explained above, the mathematical expression of this idea is represented by the notion of ergodicity. Incidentally, the latter is identified by Nobel Laureate Paul Samuelson (1969, p. 184) as the ‘sine qua non of the scientific method in economics’.

⁴⁷ Both Keynes (1920) and Knight (1971[1921]) associate the notion of uncertainty with non-measurable probability. We have already referred above to the definition of uncertainty in Keynes's work. As for the definition of uncertainty in Knight (*op. cit.*), Runde (1998, p. 543) argues that Knight proposes a *tripartite* schema of probability which can be restated as follows:

1. 'Classical' or *a priori* probability which corresponds to the ideal case in which numerical probabilities can be computed by assigning them to equally probable and mutually exclusive possible outcomes such as the six sides of a perfect die.
2. 'Statistical' probability which refers to situations in which frequencies may be obtained by carrying out an empirical (and complete) taxonomy of potential outcomes which are then divided into classes of *less* than perfectly homogenous trials.
3. 'Estimates': this corresponds to situations in which it is either impossible to calculate *a priori* probabilities or where there is an *insufficient* number of trials which are 'like' enough to construct a reference class of trials in order to obtain frequencies.

As Runde (*op. cit.*) notes, this reformulated version of Knight's taxonomy of probability situations leads to the key Knightian distinction between 'risk' and 'uncertainty'. The former refers to situations in which decision-makers can calculate either *a priori* or statistical probabilities whereas the latter refers to situations in which it is not possible to obtain either *a priori* or statistical probabilities. Crucially, Knight makes it clear that, in practice, it is impossible to obtain an entirely homogenous taxonomy of different types of trials thereby making the theoretical distinction between 'statistical' probability and 'estimates' a *matter of degree* (*op. cit.*, p. 225).

⁴⁸ We argued above that one of the themes of the *Treatise on Probability* that made its way into Keynes's later economic writings is the possibility that probability is *unmeasurable*. Therefore, most interpretations of the notion of 'uncertainty' in Keynes tend to associate uncertainty with situations in which we cannot measure the relevant probabilities. Keynes refers to this scenario in his *QJE* paper (Keynes, 1937). For instance, he argues that entrepreneurs cannot rely on any 'scientific' evidence when making long-term investment decisions because most investment decisions are *unique* in the sense that any statistical data generated from the past is not useful to evaluate the statistical probability of different potential outcomes. As he explains in a much-quoted passage:

'By "uncertain" knowledge, let me explain, I do not mean merely to distinguish what is known for certain from what is only probable. The game of roulette is not subject, in this sense, to uncertainty; nor is the prospect of a Victory bond being drawn. Or, again, the expectation of life is only slightly uncertain. Even the weather is only moderately uncertain. The sense in which I am using the term is that in which the prospect of a European war is uncertain, or the price of copper and the rate of interest twenty years hence, or the obsolescence of a new invention, or the position of private wealth-owners in the social system in 1970. About these matters there is *no scientific basis* on which to form any calculable probability whatever. We simply do not know' (*op. cit.*, pp. 213-14, emphasis added).

⁴⁹ By contrast, in the theoretical framework developed in Heiner (1983, p. 561), the predictable features of individual behaviour do not arise from optimizing with no uncertainty in choosing their most preferred behaviour. On the contrary, Heiner shows that, in the special case of no uncertainty, the behaviour of fully optimizing agents who respond with complete flexibility to every perturbation in their environment would not produce easily recognizable patterns but rather would be extremely difficult to predict.

⁵⁰ An example of this is the story in John Ford's classic Western 'The Man Who Shot Liberty Valance'. Ranse Stoddard (James Stewart's character) makes a career as a State Governor and U.S. Senator largely on the basis of his reputation as 'the man who shot Liberty Valance'. However, as we all know, it was Tom Doniphon (John Wayne's character) who really shot him.

⁵¹ As Hempel (1949, p. 467, emphasis added) argues:

'The method of empathy is, no doubt, frequently applied by laymen and by experts in history. But it does not by itself constitute an explanation; it is rather essentially a *heuristic device*; its function is to suggest certain psychological hypotheses which might serve as explanatory devices in the case under consideration'.

⁵² No doubt, the ability of Keynes to adopt the point of view of financial market participants in this case was, arguably, enormously facilitating by his own experience as a speculator in London's stock market.

⁵³ In the *General Theory* Keynes (1936, p. 96) defines the 'psychological law of consumption' as the law according to which 'men are disposed, as a rule and on average, to increase their consumption as their income increases, but not by as much as the increase in their income'.

⁵⁴ This account of the conduct of investors is, according to Runde (1990), consistent with the terms of the discussion in Chapter 26 of the *Treatise* where Keynes distinguishes between 'the most probable forecast we can make and our confidence in that forecast' (Keynes, 1920, p. 286) and where he links low 'weight' to low confidence.

⁵⁵ That a decrease in 'confidence' and its associated increase in liquidity preference constitute a 'rational' response of economic agents is hardly questionable. For instance, in many choice situations more can be learned about the factors governing eventual outcomes after decisions have been made. This presents no problem where choices can be completely and costlessly reversed. But things are very different where they cannot. Such irreversibility entails that it may sometimes be 'rational' to suspend judgement and delay commitment until more information has been acquired. In this context, the function of liquidity is that of 'giving us time to think' (Hicks 1974, p. 57). In general, however, decisions cannot be postponed until all the evidence is available and, in such cases, the readiness and terms at which commitments to previous choices may be dissolved assumes importance (Runde 1994, p. 136). Therefore, in situations of uncertainty liquid assets carry a premium over illiquid ones.

⁵⁶ For instance, Carvalho (1988, p. 79) distinguishes between long-term investment decisions and short-term production decisions. Unlike the former, short-term production decisions tend to be repetitive, do not normally imply irreversible commitments of financial resources and can be checked and reversed after very short intervals.