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DEALING WITH COMPLEXITY Marshall and Keynes on the Nature of Economic Thinking

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DEALING WITH COMPLEXITY.

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1. Introduction

In their conception and practice of economics, Alfred Marshall and John M. Keynes have been increasingly regarded as old-fashioned economists. According to a widely shared opinion in mainstream economics, they adopted loose definitions and generic concepts; they did not make extensive use of mathematics as “an engine of inquiry”; they were unsystematic in their discussion; they did not support their opinions by means of systematic statistical analysis. All of this stands in sharp contrast with the conception of economics largely prevailing after the Second World War, which is based on deductive models, consistent with standard economic principles and highly dosed with mathematics, which have to be econometrically tested and applied to reality in order to achieve general results able to hold for all times and institutional contexts.

A consequence of the dominance of this conception has been that Marshall and Keynes – although they have been recognised as having offered important contributions to the development of modern economics - have been considered economists belonging to an older era of economics when the methodological (and analytical) status of our discipline had not yet been clearly defined and generally shared.

However, there were a small number of economists who were more hesitant to share this prevailing opinion and even tended to go against it in the post-war years and even in the 1970s and 1980s, times

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when this approach was most widespread.² In their opinion what the first group of economists reproached Marshall and Keynes for – looseness of definition, non systematic use of mathematics and statistics, limited scope for pure theory – did not prove that their thought was obsolete, but rather gave evidence that they had a lively sense that economic phenomena are interrelated in a complex way and that history and institutions play a role in their evolution. They claimed that Marshall and Keynes had a clear understanding of the specificity of the economic reasoning and were aware of the problem of using formal methods to cope with complexity. This is actually an issue not yet solved in a totally satisfying way in our contemporary era. As Coase (1975) wrote discussing Marshall on method, they maintained that the events since the 1940s would hardly have led them to change their view that the extensive use of formalism would lead economists away from constructive work.³

The music changed a bit in the 1990s when an increasing number of economists successfully challenged the mainstream approach in many sub-fields. They thought it worked well only for structurally simple models but was inadequate or wrong for complex economic systems. There were more references to our 'old-fashioned authors', especially Marshall, who were considered the precursors of the new wave of a somewhat heterodox economics. Their epistemological and methodological thought became a topic of interest⁴. However, some of these references were too often quite

² We refer to authors like P. W. S. Andrews, G. B. Richardson, J. K. Whitaker, B. Loasby and G. Becattini (and also some Chicago economists like Viner and Coase), in regard to Marshall, and J. Robinson, G. Shackle, J. Harcourt and V. Chick , in regard to Keynes.

³ One of the clearest Marshall-Keynes-type methodological positions that clash with modern economic analysis was expressed by G. B. Richardson in his important *Information and investment* (1960): "It seems .. that a satisfactory explanation of economic activity cannot be given wholly, or even chiefly, in terms of the concepts appropriate to the description of physical systems; for we have to take explicit account of factors for which no convincing physical analogues are available, factors such as differences or uncertainty of opinions, or the spontaneous or deliberate developments of institutions which facilitate communication. The appropriate methodological position is surely one of tolerance and eclecticism, of choosing the approach and terminology which seems to suit the subject in hand, of indiscriminate plundering of concepts from other fields whenever they seem illuminating. If, out of loyalty to a rigid methodology, or likely because of habit or prevailing fashion, we endeavour to squeeze a knowledge of economic activity into a conceptual straight jacket borrowed from mechanics, we are likely, as a result, to ignore, distort or play down those inconvenient aspects of reality which do not easily fit. This is undoubtedly happening in much modern economic analysis" (p. 41, note).

⁴ This has happened thanks to the works of scholars like M. Dardi, T. Raffaelli, B. O'Donnell, A. Carabelli, B. Gerrard, J. Runde, T. Lawson and the Critical Realism Group (without forgetting some recent contributions of the economists cited in note 2).

superficial, if not pure lip-service, and did not tackle the questions Marshall and Keynes dealt with. In many cases, these authors were treated as only as old-fashioned fellow-travellers.

It is my opinion that in a discussion of this issue – the supposed old-fashioned attitude of Marshall and Keynes towards economics – the question of the nature and method of economic thinking of the two authors needs to be deeply examined. This also involves a history-of-thought-type question: “Did they have a common philosophical and methodological concept of economics?”. There is no established answer to this. One certainly tends to say yes. However, with a very few exceptions, the issue has been scarcely discussed comprehensively by the historians of economic thought. An inquiry into this topic would allow us to shed more light on the characteristics and interrelationship of the old and new schools of Cambridge. It could also help us handle our first question on the theoretical progress of economics with reference to the Marshall’s and Keynes’ era (The technical progress is not an issue). Have the obviously indisputable accomplishments of economics in the second part of the Twentieth Century been accompanied by a consciousness of the methodological issues involved in the economic discourse of both mainstream and heterodox economists? In other words, are Marshall’s and Keynes’ views on the nature of economic thinking outmoded and is the methodological question in economics, as they put it, definitely over?

The purpose of this paper is to discuss these questions. The fact that sometimes, but quite regularly, doubts on these questions emerge in the minds of economists, seems to be a good reason for supposing that they should not be forgotten. Perhaps this could turn out to be one of these cases in which “we stand to profit from visit to the lumber room” (Schumpeter 1954: 4).

2. Marshall on the nature and method of economics in the *Principles of Economics*

2.1. Towards the *Principles*: “The present position of economics”

Marshall's interest in economics began in a period in which this discipline was confronted with an identity crisis due to the theoretical and political difficulties of classical economists' apparatus. In addition, there were the attacks of those who, like Comte, argued against any separate study of any single part of social phenomena and people who, like those of the historical school argued against any formal theory and preferred a kind of 'from fact to fact' reasoning. One of the issues of this crisis was the scientific status of economics. Is economics a science ? If so what type of science is economics ? What is its method ? These were the crucial questions at stake. To answer these questions was Marshall's task.

As Schumpeter wrote, "the discovery that there is a thing as a general method of economic analysis" was not Marshall's, "but no economist before Marshall ever grasped the meaning of this so fully" (1941: 101-2). The point is clearly made by Marshall in "The present position of economics", his 1885 Cambridge introductory lecture. Here he begins refuting Comte's and historical school's criticisms. Marshall maintains that "the complexity and intricacy of social phenomena afford no reason for dispensing with the aid of the economic organon in its proper place: on the contrary they increase the necessity of it". He refutes the historical school maintaining that "facts by themselves are silent" (Marshall 1925 [1885]:166). His second step was to clarify his position on classical political economy. Marshall stresses his continuity with Ricardo and the classical economists as founders of economics on a scientific basis, but he also points out what he thinks to be their error: "Ricardo and his followers neglected a large group of facts". He writes:

They regarded man as, so to speak, a constant quantity, and gave themselves little trouble to study his variations ... [They did not allow for] human passions, instincts and habits, sympathies and antipathies ... They therefore attributed to the forces of supply and demand a much more mechanical and regular action than they actually have ... They did not see how liable to change are the habits and institutions of industry (ibid.: 155).

Marshall maintains his generation had shifted their perspective on economics “due to the discovery that man himself is in a great measure a creature of circumstances and change with them” (ibid.: 153). He emphasises that economics is indebted to the scientific movement for this change, particularly to biology, which had permitted the emergence of clearer ideas as to the nature of organic growth. Finally

Marshall identifies the function of economic theory in supplying a machinery “to aid us in reasoning about those motives of human action which are measurable”. In this sense “[Economics] is not a body of concrete truth, but an engine for the discovery of concrete truth” (ibid.: 159). This scientific machinery allows the economists to work “in the light of facts”(ibid.: 171).

In the years immediately before the publication of the *Principles* Marshall had an important discussion with J.N. Keynes about his book *Scope and Method of Political Economy*, the proofs of which Marshall read and commented on. In a letter to J.N. Keynes probably from September, 1889, Marshall indicates where they differ, objecting to Keynes' “more orderly nature” and saying that he had taken “an extreme position as to the *methods & scope* of economics”. Marshall goes on:

In my new book – I say of *methods* simply that economics has to use every method known to science. And as to the scope, I say ‘Economics is a study of mans actions in the ordinary business of life .. it inquires how he gets his income & how he uses it’ (letter of September 1889).

And as regards the definition, he says:

Generally I never discuss any line of division or demarcation except to say that nature has shown no hard & fast lines, & that any lines man draws are merely for the convenience of occasion: & shd never be treated as though they were rigid (ibid.).

The final systematisation of his methodological thought took place in the *Principles*. As it is well known, the *Principles* had eight editions. However, in reference to the question of method, a comparison of the different editions shows that the final version was drafted between the third and fifth edition – i. e., between the middle of the 1890s and 1907. Furthermore, an examination of the variants in the text through all the editions reveals that they are mainly stylistic, but that his ideas and the key reasoning had remained clearly defined since the first edition of 1890.

2.2. The *Principles*: Economics as a science of social complexity

In chapter 2 of the *Principles*, Marshall defines economics as “a study of men as they live and move and think in *the ordinary business of life*” (Marshall 1961: 14). Shortly after he counters the excessive abstraction of theoreticians like Ricardo and Walras, emphasising that economics studies “the actions

of individuals ... in relation to social life ... They deal with man as he is: not with an abstract or 'economic man'; but *a man of flesh and blood*" (ibid.: 26-7, my italics). Marshall specifies that economics focuses on that side of life in which "man's conduct is more deliberate and in which he most often reckons up the advantages and disadvantages of any particular action before he enters on it" (ibid.: 20-1). This subject is amenable to quantification and therefore, to some degree, "to treatment by scientific machinery" (ibid.: 15). Economics is a science⁵, Marshall maintains. However, he adds that economics differs from the 'harder' sciences⁶, particularly mathematical physics. It must follow the example of exact sciences despite the fact that their simplicity and precision are not attainable because of the variety and uncertainty of human actions. Marshall writes:

Let us then consider more closely the nature of economic laws, and their limitations. Every cause has a tendency to produce some definite result if nothing occurs to hinder it .. The law of gravitation states how any two things attract one another; how they tend to move towards one another, and will move towards one another if nothing interferes to prevent them. The law of gravitation is therefore a statement of tendencies. It is a very exact statement .. Now *there are no economic tendencies which act as steadily and can be measured as exactly as gravitation can*: and consequently there are no laws of economics which can be compared for precision with the law of gravitation (ibid.: 31, my italics)

At that time some critics said that the term 'economic law' was inappropriate because there were no definite and universal propositions in economics equivalent to the physics' laws of gravitation and of conservation of energy. Marshall refuted the objection as irrelevant. In a passage of the 3rd and 4th editions of the *Principles*, Marshall writes:

⁵ As a science, economics uses both induction and deduction - Marshall writes at the beginning of chapter 3 of *Principles*. Quoting from Schmoller, Marshall writes: "<<Induction and deduction are both needed for scientific thought as the right and left foot are both needed for walking>>" (Marshall 1961: 29). Then he comments: "The methods required for this twofold work are not peculiar to economics; they are the common property of all sciences. All the devices for the discovery of the relations between cause and effect, which are described in treatises on scientific method, have to be used in their turn by the economist: there is no any one method of investigation which can properly be called the method of economics; but every method must be made serviceable in its proper place, either singly or in combination with others" (ibid.).

⁶ Marshall writes that "economics aspires to a place in this group of sciences [physical sciences]: because though its measurements are seldom exact, and are never final; yet it is ever working to make them more exact, and thus to enlarge the range of matters on which the individual student may speak with the authority of his science" (ibid.: 31).

Though there are no economic laws of that class, there are many which may rank with the secondary laws of those natural sciences, which resemble economics in dealing with the complex action of many heterogeneous and uncertain causes (Marshall 1961, vol. II: 148-9).

Economics is for Marshall a discipline which aspires to be a science of social complexity⁷. Actually Marshall compares the laws of economics to those of biology and to the laws of tides:

The laws of biology, for instance, or – to take an example from a purely physical science – the laws of tides, like those of economics vary much in definiteness, in range of application and in certainty (ibid.) Economics, like biology, deals with a matter, of which the inner nature and constitution, as well as the outer form, are constantly changing (Marshall 1961: 772).

The laws of economics have to be compared with the laws of the tides ... People can calculate beforehand when the tide will *probably* be at its highest on any day at London Bridge ... No one knows enough about the weather to be able to say beforehand how it will act (ibid.: 32).

In Book 1, Chapter 4, Marshall again emphasises: “In sciences that relate to man exactness is less attainable”. In history for example:

The scientific student of history is hampered by his inability to experiment and even more by the absence of any objective standard to which his estimates of relative proportion can be referred. Such estimates are latent in almost every stage of his argument: he cannot conclude that one cause or group of causes has been overridden by another without making some implicit estimate of their relative weights. And yet it is only by a great effort that he perceives how dependent he is on his own subjective impressions (ibid.: 44).

Marshall recognises that the economist is also hampered by this difficulty, but he is hampered less than other students of man’s actions:

indeed he has some share in those advantages which give precision and objectivity to the work of the physicist. So long, at all events, as he is concerned with current and recent events, many of this fact group themselves under classes as to which statements can be made that are definite, and often were approximately accurate numerically; and thus *he is at some*

⁷ This complexity has several facets. As regards the forces that cause movement, they are “numerous”, not definite, scarcely known and diverse in character. Its material is uncertain, heterogeneous and constantly changing: “The forces of which economics has to take into account are more numerous, less definite, less well known, and more diverse in character than those of mechanics; while the material on which they act is more uncertain and less homogeneous” (Marshall 1961: 772).

advantage in seeking for causes and for results which lie below the surface, and are not easily seen; and in analysing complex conditions into their elements and in reconstructing a whole out of many elements (ibid., my italics).

It is apparent from this reconstruction that Marshall is very conscious of the difficulty of treating economics as a science, which he defines so extensively. The problem lies in the subject-matter itself of economics, the “living and ever-changing economic organism” (ibid.: 769). This raises the economist’s problem of how to deal with complexity - the problem of method.

2.3. The economist’s method of dealing with complexity

2.3.1. Facts, reason and common sense

How does the economist have to deal with complexity ? In the first paragraph of chapter 4 of book I, Marshall writes that the economist must start from the analysis of facts - “The economist must be greedy of *facts*”. As “facts by themselves teach nothing”, he must use reason: “*reason* alone can interpret and draw lessons” from the “sequences and coincidences” that history tells about, where ‘reason’ means deductive or abstract reasoning. This is not enough, however: “The work to be done is so various that much of it must be left to be dealt with by *trained common sense*, which is the ultimate arbiter in every practical problem”. It follows that:

‘Economic science is but the working of common sense aided by appliances of organised analysis and general reasoning, which facilitate the task of collecting, arranging, and drawing inferences from particular facts’ (ibid.: 38, my italics).

Marshall emphasises that common sense must be ‘trained’ to carry out its task. In fact he distinguishes (Marshall 1885) between “untutored common sense or public opinion” and trained common sense. The first is knowledge based on surface phenomena unconcerned with the complexity of reality. The second is a sort of conscious common sense, which is concerned with complexity, gives flexibility to reason, contextualizes theoretical models, and avoids the risks of abstract reasoning.

The crucial position that Marshall gives to trained common sense – as if it were a sort of superior reasoning - has an important implication for the language of economics. Marshall writes that “[economics’] .. *must* endeavour to conform itself to the familiar terms of everyday life, and so far as possible must use them as they are commonly used” (Marshall 1961: 51). For Marshall everyday

language makes it possible to maintain the *shades of meaning* that in common use every word has, which can be interpreted “by the context” (ibid.: 51, my italics):

The economist ... must make the terms in common use serve his purpose in the expression of precise thought, by the aid of qualifying adjectives or other indications in the *context*. If he arbitrarily assigns a rigid exact use to a word which has several more or less vague uses in the market place, he confuses business men, and he is in some danger of committing himself to untenable positions (ibid.: 81-2, my italics)

This ‘complex’ approach to the economic problem requires that the good economist has many qualities. Marshall writes:

“The economist needs the three great intellectual faculties, perception, imagination, and reason: and most of all he needs imagination, to put him on the track of those causes of visible events which are remote or lie below the surface, and of those effects of visible causes which are remote or lie below the surface” (ibid.: 43).

The possession of those faculties enables the economist to study concrete cases in depth to – i.e., to use what Marshall calls the intensive method of research.⁸

In dealing with complexity, the role of deductive reasoning is limited. It does not exhaust the economist’s entire reasoning at all. As Marshall writes in his often cited letter to Edgeworth (August 28, 1902), “abstract, or general, or theoretical economics” seems to him “an essential but a very small part of economic proper”. What is the exact role of abstract reasoning in economics for Marshall ? This question deserves to be taken further.

⁸ In *Principles* (Part III, chapter 4) there is a note on the difficulties of the statistical study of consumption. Marshall distinguishes between two methods of research, intensive and extensive. He cites Frédéric Le Play’s *Les ouvriers européennes* as a good example of intensive method. Le Play was a mathematician and engineer who, according to Schumpeter, “deserves a place in the history of economic analysis because of the method of studying family budgets” (Schumpeter 1954: 523):

"The method of Le Play's monumental *Les Ouvrières Européennes* is the *intensive* study of all the details of the domestic life of a few carefully chosen families. To work it well requires a rare combination of judgement in selecting cases, and of insight and sympathy in interpreting them. At its best, it is the best of all: but in ordinary hands it is likely to suggest more untrustworthy general conclusions, than those obtained by the *extensive* method of collecting more rapidly very numerous observations, reducing them as far as possible to statistical form, and obtaining broad averages in which inaccuracies and idiosyncrasies may be trusted to counteract one another to some extent" (Marshall 1961: 116) .

2.3.2. The role of abstract (deductive) reasoning

To cope with complex problems, the economist first divides them into parts in order to reduce them to simple problems, using the hypothesis of *ceteris paribus* and excluding the influence of time (that is, adopting the statical method which assumes static or stationary conditions). He then proceeds step by step to successive approximations. This procedure is effective for the earlier stages of economic reasoning. In 1898 Marshall answered his critics, focusing mainly on clarifying the nature and limitations of the statical method in economics. He writes:

There is a fairly close analogy between the earlier stages of economic reasoning and the devices of physical statics. But is there an equally serviceable analogy between the later stages of economic reasoning and the methods of physical dynamics ? *I think not.* I think that in the later stages of economics better analogies are to be got from biology than from physics; and consequently, that *economic reasoning should start on methods analogous to those of physical statics, and should gradually become more biological in tone ...* The method will become ever more remote from the physical and more akin to the biological (Marshall 1898: 39, my italics).

He specifies:

The catastrophes of mechanics are caused by changes in the quantity and not in character of the forces at work: whereas in life their character changes also. ‘Progress’ or ‘evolution’, industrial and social, is not mere increase and decrease. It is organic growth, chastened and confined and occasionally reversed by decay of innumerable factors, each of which influences and is influenced by those around it; and every such mutual influence varies with the stages which the respective factors have already reached in their growth (ibid.: 42-3).

Furthermore the mathematical engines used in physics, which “work out large volumes full of mathematical formulae and figures” cannot be applied to economics:

The most helpful applications of mathematics to economics are those which are short and simple, which employ few symbols; and which aim at throwing a bright light on some small part of the great economic movement rather than at representing its *endless complexities* (ibid.: 39).

What is the function of deductive reasoning in economics ? Marshall writes: “it is not to forge a *few long chains of reasoning*, but to forge rightly *many short chains* and single connecting links”

(*Principles*, appendix C, p. 773). This aspect is taken up again in Appendix D, “Uses of abstracting reasoning in economics”, where Marshall explains that it is illusory to think that there is room for long trains of deductive reasoning in economics since economic material is often inadequate to bear the strains of the mathematician’s machinery:

It is obvious that there is no room in economics for long trains of deductive reasoning ... It may indeed appear at first sight that the contrary is suggested by the frequent use of mathematical formulae in economic studies. But on investigation it will be found that this suggestion is illusory ... [The mathematician] takes no technical responsibility for the material, and is often unaware how *inadequate* the material is to bear the strains of his powerful machinery (ibid.: 781).

Hence Marshall maintains that it is the nature of economic material that limits the use of mathematics.. The reason that long trains of deductive reasoning cannot be made is that, as we move from a determined situation, the variables at stake increase in number and intensity in relation to external circumstances. *It is not a problem to manipulate more givens, Marshall emphasises, but rather to widen the connections.* In other words, it is impossible to characterise a few causes as predominant to render the hypothesis of *ceteris paribus* practicable. The attempt to translate a complex problem into a system of equations is bound to fail for considerations “connected with the manifold influences of the element of time”:

While a mathematical illustration of the mode of action of a definite set of causes may be complete in itself, and strictly accurate within its clearly definite limits, it is otherwise with any attempt to grasp the whole of a *complex problem of real life*, or even any considerable part of it, in a series of equations. For many important considerations, especially those connected with *the manifold influences of the element of time*, do not lend themselves easily to mathematical expression: they must either be omitted altogether, or clipped and pruned till they resemble the conventional birds and animal of decorative art (ibid.: 850, my italics).

Omission of certain factors and/or their ‘embellishment’ in order to render them mathematically manageable are the consequences of the problem with lending these factors to mathematical expression. This problem deserves to be emphasised, because, according to Marshall, it “arises a *tendency towards assigning wrong proportions* to economic forces”:

those elements being most emphasised which lend themselves most easily to analytical methods. No doubt this danger is inherent in every application not only of mathematical analysis, but of analysis of any kind, to the problem of real life. It is a danger which more than any other the economist must have in mind at every turn (ibid.: 850-1, my italics).

The risk of concentrating on the variables more easily reducible to analytical treatment at the expense of the realism of the model is frequently mentioned by Marshall. It often reappears in his correspondence with colleagues. For example, in a letter to Bowley (February 21, 1901) he is particularly effective in his argument against formalism:

I think the economic, as distinguished from the mathematical, student is hurt by being invited to spend his time on them [mathematical toys], before he has made a sufficiently realistic study of those statistics to know roughly, without calculation, on which side of the target the center of the shots lies. He assumes there is no wind. I believe that a Boer marksman, who takes account of the wind, will by instinct get neater the truth than he by mathematics.

2.2.3. Abstract reasoning at work: Book V of the *Principles*

The role and limits of abstract reasoning are illustrated in Book V of *Principles*, entitled "General relations of demand, supply and value", the only 'theoretical' book of the entire volume. "The word 'Theory' applies to the title of that book alone. It deals with abstractions", Marshall writes in his 1898 article:

Its aim is not so much the acquisition of knowledge, as of power; power to order and arrange knowledge ... When so isolated [the chief economic forces at work] will almost always show an equilibrium point .. And the conception of this equilibrium point helps to give precision to the ideas (Marshall 1898: 52)

This equilibrium is conceived as a mechanical equilibrium: "a simpler balancing of forces which corresponds rather to the mechanical equilibrium of a stone hanging by an elastic string, or of a number of balls resting against one another in a basin" (ibid.: 323). Its purpose is to lay the way for the study of the equilibrium "as resembling a balancing of forces of life and decay" (ibid.).

Marshall studies the theory of value with regards to the normal cost of production of a commodity relative to a given aggregate volume of production in a competitive context. The first step of the analysis is the definition of equilibrium of normal demand and supply of a commodity that obeys the law of diminishing returns. The second step is the definition of equilibrium with reference to short and long periods. Here Marshall introduces the fiction of the stationary state, less abstract than the usual static conditions. After that, Marshall aims to limit the abstractness of reasoning in the analysis of long

term equilibrium. He refused to assume that "every business remained always of the same size and with the same trade connections" (ibid.: 367). Instead, Marshall introduces the representative firm. This is a 'normal firm' – in the sense that it "must be one which has a fairly long life, and fair success, which is managed with normal ability, and which has normal access to the economies, external and internal, which belong to that aggregate volume of production" (ibid.: 317). This firm grows with an increase in the aggregate volume of production. Some firms rise and others decline. The representative firm represents the average firm. In this way Marshall brings together the equilibrium of the industry and the disequilibrium of the individual firms which are members of the industry.

The difficulty and risks of assuming the *ceteris paribus* condition "reach their highest point in connection with industries which conform to the law of Increasing Returns" (Marshall 1898: 49). It is just in connection with those industries that "the most alluring applications of the method are to be found" (ibid.). Long-term supply curves in relation to such industries are unrealistic, Marshall says: "[They] are fascinatingly clear and vivid, but they are made too clear and vivid to be at all near to reality" (ibid.). The analysis of equilibrium with reference to increasing returns is the most important case in which the use of the hypothesis of *ceteris paribus* is not practicable. In a note in chapter 12 of book V Marshall writes:

Abstract reasoning as to the effects of the economies in production, which an individual firm gets from an increase of its output are apt to be misleading, not only in detail, but even in their general effect. This is nearly the same as saying that in such case the conditions governing supply should be represented in their totality. They are often vitiated by difficulties which lie rather below the surface, and are especially troublesome in attempts to express the equilibrium conditions of trade by mathematical formulae (ibid.: 459n)

And he continues criticising "the great Cournot" who in this case, according to Marshall, misapplied mathematics:

Some, among whom Cournot himself is to be counted, have before them what is in effect the supply schedule of an individual firm; representing that an increase in its output gives it command over so great internal economies as much to diminish its expenses of production; and they follow their mathematics boldly, but apparently without noticing that their premises lead inevitably to the conclusion that, whatever firm first gets a good start will obtain a monopoly of the whole business of its trade in its district. While others avoiding this horn of the dilemma, maintain that there is no equilibrium at all for commodities which obey the law of increasing return; and some again have called in question the validity of any supply schedule which represents prices diminishing as the amount produced increases ... (ibid., see also Marshall 1898)

In the same note Marshall refers to Note XIV of the Mathematical Appendix. There he maintains that in the case of commodities whose expenses of production diminish rapidly with every increase in the amount produced, "the causes that govern the limits of production are so complex that it seems hardly worth while to attempt to translate them into mathematical language" (ibid.: 849).

According to Marshall, economic reasoning must abandon the mechanical method at this point of complexity and become "more biological in tone" in order to solve this difficulty. This is the fundamental role of the device of the *representative firm*. Here, in fact, it is *necessary* 'especially when we are *considering industries which show a tendency to increasing return*' (Marshall 1961: 376n, our italics). He writes that "by concentrating our attention on such a firm we escape many of the difficulties which attach to problems of very long period equilibrium" (Marshall 1898: 50). Marshall observes that the tendency to a fall in the price of a commodity as a result of a gradual development of the industry that makes it is 'quite a different thing from the tendency to rapid introduction of new economies by an individual firm that is increasing its business' (Marshall 1961: 376). The reason is that a firm grows and decays. If this is not taken into account, there is the risk of falling into 'Cournot's error'. The device of the representative firm - representative of the average life cycle of the firm in the industry - permits avoiding this methodological error. Trained common sense is here at work: it brings the experience of life and history which permits understanding that theoretical notions must be taken broadly. So, it 'explains' what theory, with its "few, long-drawn-out and subtle reasonings", by itself cannot do.

Is the solution of the difficulty of complexity in economics offered by Marshall satisfactory ? The answer of most economists of new generations at that time, at least with regards to the problem of the co-existence of increasing returns and competition, was negative.

2.4. Marshall's dilemma

In our reconstruction of Marshall's thought, economics is conceived in a broad sense as a science of complexity. To cope with complexity, economics cannot be only "abstract reasoning", which is unable "to disentangle the interwoven effects of complex causes". For this work, "abstract reasoning" is essential. In fact, Marshall writes to Edgeworth in the letter cited above, "but a wide and thorough study of facts is equally essential". To do this, abstract reasoning has to be combined with trained common sense and the economist has to have intellectual faculties such as perception and imagination

beyond reason also in order to study specific cases intensively. The problem of value and competition is an example of great importance for Marshall of this "necessary" combination. When the complexity of the problem at issue makes the *ceteris paribus* assumption not practicable, a "biological instrument" like common sense must be used to avoid "Cournot's error". In the specific case of the problem of the coexistence of increasing returns and competition, Marshall's solution - the device of the representative firm - does not seem to be satisfactory. Firstly, it holds the discussion of increasing returns inside the unnatural cage of the stationary state and does not analyse the path to equilibrium. These are two of the limitations quoted in economic literature, already pointed out in the 1920s by Marshallians like Young and Shove (Marchionatti 1992). Secondly, it is not satisfactory because it is based on a characteristic of Marshall's conception of scientific investigation that may be interpreted *ex post* as a weakness. In the passage from methods of reasoning analogous to those of physical statics to methods "more biological in tone" the question remains - when does this passage occur? According to the principle of continuity Marshall sees the passage from one to another form of knowledge as a continuum, as a result of the application of the method of successive approximation⁹. Moreover, in Marshall's discourse the passage seems to be highly dependent on the subjective capabilities of the economist. This is quite problematic for such a would-be scientist as the economist is. It was for Marshall, too, who considers the intensive method of research the best of all. However, it "requires a rare combination of judgement in selecting cases, and of insight and sympathy in interpreting" the facts, so that "in ordinary hands it is likely to suggest more untrustworthy general conclusions, than those obtained by the *extensive* method" (Marshall 1961: 116).

A dilemma comes up again that Marshall hoped to overcome. If economics is reduced to abstract reasoning it can make an exact, scientific, discourse, but that runs the risk of becoming sterile. If economics wants to cope with complexity, it risks indeterminateness and perhaps excessive dependence of subjectiveness. So, Marshall's dilemma seems to run itself into the ground between sterile exactness and indeterminate concreteness.

In the Twenties Marshall's solution of the problem of 'increasing returns and competition' was seen as an inextricable mixture of statics and dynamics, the expression of a vague and inaccurate theory of competition (Marchionatti 2000 and 2001). Economists like Knight, Schumpeter, Robbins (and partially Young), considered Marshall's path not practicable and so favoured a clear separation between statics and dynamics as different fields of inquiry and considered increasing returns a dynamic

⁹ My hypothesis for the reasons for Marshall's failure to pass from the mechanical to biological perspective presents some affinities with Pratten's (1998) explanation of Marshall's inability to realize his planned program of research.

phenomenon to be investigated in the field of dynamics. In other words they saw a solution of continuity where Marshall had seen continuity. Most of Marshall's critics rejected his representative firm device as well as his idea of economics as a science of complexity. They preferred economics as a 'natural science', throwing out the baby with the bath-water. Keynes was sympathetic with the critics of Marshall on the point of representative firm (Marchionatti 2001). Keynes was also probably thinking of the problem of increasing returns and competition when he wrote that "In his reaction against excessive addiction to these methods [diagrams and algebra] .. Marshall has gone too far" (Keynes 1924: 188). However, Keynes does not give up Marshall's conception of economics. On the contrary, he deepened the search of the middle way that Marshall pointed out.

3. Keynes on the nature of economics and its method in the years of the *General Theory*

3.1. The development of Keynes' thought before the 1930s

Before the 1980s no real attention had been paid to the topic of Keynes' method. The prevailing view was that Keynes was "pretty uncertain as to the meaning he wanted to attach to economic theory" (Coddington 1976: 57). The new studies published at the beginning of the 1980s (O'Donnell 1982, Skidelsky 1983, Lawson and Pesaran 1985, and Carabelli 1988 -to quote the most exhaustive) focused on Keynes' works before the *General Theory*, his early writings on probability and philosophy, and particularly on *A Treatise on Probability*, showing the relevance of them for understanding his economics. Nevertheless, these studies largely neglected the role of Marshall in the development of Keynes' methodological reflection. Marshall is occasionally remembered as an precursor of Keynes' thesis, but their actual relationship is not gone into. More recently the influence of Marshall has been recognised (Raffaelli 1996, Coates 1996 and O'Donnell 1997). The purpose of this section is to reconstruct the development of Keynes' thought on method briefly, to provide more evidence of Marshall's undeniable influence on him, and to show that Keynes' methodological statements can be seen as the result of both: Marshall and the *Treatise's* epistemology.

3.1.1. The period 1904-1921: Probability, but not only

In the period of his intellectual formation philosophical interest prevails in Keynes. The *Treatise on Probability*, where his epistemology finds its foundations, is the result of a long intellectual labour which originates in Keynes' critical reaction to Moore's *Principia Ethica*. It was first formulated as his fellowship dissertation completed in 1907. It was turned to a book in the following pre-war years, but published only in 1921. The book's main purpose was to give a logical basis to probability that is, to define a logic of induction, working in the English analytical tradition, renewed by Bertrand Russell's *Principia Mathematica*. Probability is defined as the degree of rational belief in a proposition on the basis of the evidence available. The validity of the inductive process for Keynes depends on the assumption that only a finite number of characteristics are relevant to the proposition under

examination. This implies, in Keynes' words, assuming the hypothesis of atomism - that the system under exam consists of atoms whose effects are distinct, independent and invariable. If the system is organic, the inductive method is invalidated. However, "the difficulties .. which are most fundamental from the standpoint of the student of probability" regard the numerical measurability of the degree of probability (as well as of the goodness and weight of argumentation). To speak of probability as a degree of rational belief, as Keynes actually did, seemed to imply that probabilities are quantitative and measurable. On the contrary, "so far from our being able to measure them, it is not even clear that we are always able to place them in an order of magnitude" (Keynes 1921: 29). Probabilities, Keynes added, even if they exist, may be unknown, due to the vagueness of knowledge. 'Vague knowledge' is defined as knowledge not susceptible to "strict logical treatment" (ibid.: 17). Furthermore, in a note at the end of the second chapter of the *Treatise*, Keynes criticises the symbolism of *Principia Mathematica* and poses the question whether symbolic analysis is more precise and less ambiguous than everyday language. He then answers that "there are advantages also in writing the English of Hume". These considerations occupy little room in the *Treatise*, but their importance increased in the following years. Coates (1996) notes that Keynes frequently uses the term 'vague' in his writings of the 1930s in order to indicate both complex economic material and the concepts which had to represent it.

In the first period of Keynes' intellectual formation there is also evidence of a fairly important influence of Marshall on the development of his thought (Raffaelli 1996 and O'Donnell 1997). Immediately before the beginning of his dissertation, Keynes first encountered economics. Keynes' working papers annotated by Marshall testify to this. Keynes was attending Marshall's lectures in order to prepare himself for the Civil Service examination. In response to his questions, he wrote several working papers on theoretical and applied economics, ranging from the definition of capital to methods of index numbers, business size, monopolistic pricing and railway services. Marshall's corrections and comments permit the reconstruction of the first dialogue between the master and his student. Here Marshall's epistemological and philosophical convictions are transmitted - not without resistance - to Keynes. As Raffaelli (1996) notes, Keynes arrived at Marshall's workshop from the mathematics course and had to learn the lesson of the experience, realism and common sense. Although Marshall had tried to induce him to pursue his studies in economics at that time, Keynes decided to become a civil servant entering the India Office. However, in the summer of 1908 he came back to Cambridge as a lecturer in economics, after Marshall retired officially and Pigou was elected to the professorship of economics. Keynes lectured on the principles of economics until 1914. It was at that time that Keynes' career as an economist began. In this period there is another important moment in the intellectual

relationship between Marshall and Keynes that reveals a remarkable common view on the application of statistical tools to social studies. In 1910 Marshall - assisted by the young Keynes - criticised Karl Pearson's views, which were expressed in his study on the influence of alcoholic parents on their children written by Karl Pearson together with Ethel Elderton¹⁰. Against the conventional belief, this study tried to demonstrate from the data that alcoholic parents exerted negligible detrimental influence on their offspring. In a letter on "Alcoholism and Efficiency" published in the letter column of the *Times*, Marshall expressed doubts on the choice of data and the inadequate account of the time element. He expressed his hope that someone "more competent" than himself would have written about the adequacy of the statistical base of the study. It was Keynes who undertook this task. At that time Keynes was particularly interested in the problem of statistical induction – the last section of his *Treatise on Probability* is devoted to it. Furthermore he had written a paper on index numbers in 1909. He did not share the theses on the probability theory expressed by Pearson, whom he called an adopter of "the Laplacian or mathematical method" (Keynes 1921: 428). Keynes published a critique in the *Statistical Journal*, highly appreciated by Marshall. He maintained that no inference of general character could be inferred from these studies because the samples were not representative of the whole population. He added that the report had not been able to show that the samples examined were homogeneous. The controversy continued in the pages of the *Times*, first between Pearson and Marshall, then between Pearson and Keynes, who replied against Pearson's "Reply to the Cambridge Economists" at Marshall's prompting. As the controversy went on, the cooperation between Marshall and Keynes got closer.

3.1.2. The 1920s: Keynes as a Marshallian

In the 1920s economics became Keynes' main interest. He was establishing himself as a leader in the Cambridge school of economics. In that years Marshall showed an increasing regard for Keynes as an economist. He derived "an exceptional pleasure and profit" from the reading of *The Consequences of the Peace* (letter to Keynes of January 1920). In 1923 Marshall welcomed the publication of the *Monetary Reform* warmly¹¹. Marshall was also very impressed with the *Cambridge Economic*

¹⁰ The episode is recounted extensively by Groenewegen in his biography of Marshall (1995).

¹¹ So Marshall writes to Keynes on the 19th of December, 1923: "Many thanks for your fascinating Monetary Reform. .. I have appointed myself amateur currency-mediciner: but I cannot give myself even a tolerably good testimonial in that

Handbook series, edited by Keynes and Henderson. This comes out in his letters to Henderson (10 January 1922) and Robertson (14 January 1922). Actually it was a "very Marshallian enterprise" as Groenewegen termed it (1995: 757)^{12, 13}.

Immediately after Marshall's death Keynes offered his synthesis of Marshall's work in his famous memoir published in the *Economic Journal* of September 1924. He was able to catch the greatness of the founder of the economic school of Cambridge better than any of his contemporaries. In Keynes' interpretation Marshall had two natures - the preacher and the scientist - and this was "the clue to Marshall's mingled strength and weakness". This diversity of nature was certainly an advantage, Keynes maintained, in the sense that it enabled Marshall to possess that rare combination of gifts which make an economist great. Keynes writes a passage as famous as it is important for helping us understand the two authors' common idea of economics:

The study of economics does not seem to require any specialised gifts of an usually high order. It is not, intellectually regarded, a very easy subject compared with the higher branches of philosophy and pure science? Yet good, or even competent, economists are the rarest of birds. An easy subject, at which very few excel! The paradox finds its explanation, perhaps, in that the master-economist must possess a rare combination of gifts. He must reach a high standard in several different directions and must combine talents not often found together. He must be mathematician, historian, statesman, philosopher – in some degree. He must understand symbols and speak in words. He must contemplate the particular in terms of the general, and touch abstract and concrete in the same flight of thought. He must study the present in the light of the past for the purposes of the future. No part of man's nature or his institutions must lie entirely outside his regards. He must be purposeful and disinterested in a simultaneous mood; as aloof and incorruptible as an artist, yet sometimes as near the earth as a politician. Much, but not all, of this ideal many-sidedness Marshall possessed. But chiefly his mixed training and divided nature furnished him with the most essential and fundamental of the economist's necessary gifts – he was conspicuously historian and mathematician, a dealer in particular and the general, the temporal and the eternal, at the same time (Keynes 1924: 173-4).

capacity. And I am soon to go away: but, if I have opportunity, I shall ask new-comers to the celestial regions whether you have succeeded in finding a remedy for currency-maladies".

¹² Keynes' introduction to the first volume of the *Handbooks* (1922), contains this Marshallian statement: "The Theory of Economics does not furnish a body of settled conclusions immediately applicable to policy. It is a method rather than a doctrine, an apparatus to draw correct conclusions ... its modes of expression are much less precise than those provided by mathematical and scientific techniques ... The main task of the professional economist now consists, either in obtaining a wide knowledge of relevant facts and exercising skill in the application of economic principles to them, or in expounding the elements of his method in a lucid, accurate and illuminating way" (p. v).

¹³ Another example of the Marshallian way of research followed by Keynes in these years is represented by the articles and notes he wrote on the crisis of Lancashire cotton industry between 1926 and 1929 (Marchionatti 1995).

Keynes claims for Marshall the title of “founder of modern diagrammatic economics” (ibid.: 185). Here lies the greatness of the scientist, but Keynes observed that this did not prevent him from getting the limits of a mathematical approach to economics. Actually Marshall understood that the economic interpretation of the “complex and incompletely known facts of experience” requires to go beyond the “bare bones of economic theory” (ibid.: 186). Keynes attributes Marshall with the capability to amalgamate ‘*logic and intuition and wide knowledge of facts*, most of which are not precise.’ This “is required for economic interpretation in its highest form” (ibid.: 186, note 2). He left this methodological legacy to his pupils (and Keynes himself among them).

Keynes' increasing interest in economics did not lead him to abandon his interest in philosophy. In fact, in the later 1920s Keynes continued to develop his philosophical reflections. In a 1926 letter to F. M. Urban, translator of the German edition of the *Treatise*, Keynes expressed disappointment in the conceptual structure of the *Treatise* and maintained that it can be improved by the development of the concept of vague knowledge, already introduced in the *Treatise* but scarcely analysed there (Keynes to F. M. Urban, 15 May 1926, in *Keynes Papers*, file TP/1₂). His reference to the importance of vague knowledge in the letter to Urban probably reflects the increasing importance that Keynes attached to circumstances characterised by structural uncertainty and his belief that probability cannot be known merely in terms of logical relations but it should be approached psychologically. In his 1930 review of Ramsey's book (Keynes 1930), he similarly reaffirmed the limits of a purely logical-formal approach to probability and the need to inquire into the field of human logic. Formal logic studies the question of the consistency of the degrees of beliefs, but it is not able to explain their bases. His acknowledgement of the limits of formal logic goes well beyond his *Treatise*. He substantially turns his theory of human conduct to a more 'general' theory of human behaviour, something that is able to consider complexity, the organic nature of social relations, and the vague character of knowledge (Marchionatti and Becchio 2000). This falls in line with his Marshallian beliefs on the characteristics and requirements of economic interpretation. The Marshallian conception of the economics as an amalgam of "logic and intuition and wide knowledge of facts", present very early in Keynes, is philosophically deepened thanks to the post-*Treatise* development of his thought. From the early 1930s it is translated at an analytical level and rid of the schemes of the ‘classical economists’. This process led to the construction of the model of *General Theory*.

3.2. The 1930s: Keynes as a thinker of economic complexity

3.2.1. Some methodological premises to the *General Theory*: vagueness and the degree of precision advisable in economics

In his Cambridge lectures (November, 1933) Keynes deals with the problem - 'What degree of precision is advisable in economics ?' (Rymes 1989: 101). According to his students' notes, Keynes maintained that 'on the matter of precise definition of terms, there is some questions as to the utility and propriety of the scholastic exercise in trying to define terms with great precision in a subject like economics' (ibid.: 102). The danger of doing so 'is that you may "precise everything away" and be left with only a comparative poverty of meaning' (ibid.). In other terms, as Keynes says: "There is the danger of falling into scholasticism, the essence of which is treating what is vague as what is precise" (ibid.). Keynes maintains that "a generalisation to cover everything is impossible and impracticable." He adds that "generalising in economics is thinking by sample, not by generalisation", a crucial statement which will be clear in the following discussion.

Coates (1996 and 1997) associates these reflections of Keynes to his involvement with Ludwig Wittgenstein's criticism of analytical philosophy beginning in the late 1920s, when Wittgenstein returned to Cambridge. Coates maintains that Keynes pointed out the problems that ensue from defining with artificial precision concepts that are characterised by what Wittgenstein defined as combinatory vagueness: "for the precise definition will leave out of account too much of what we intuitively intend when using the concept" (Coates 1997: 249). Marshall's influence on Keynes' reflection too, however, is explicit in the 1933 lectures. Here Keynes positively referred to Marshall's method in his criticism of the scholasticism. He asks what precision is useful in economics. He then notes that Marshall's definitions were very loose, that many terms were not defined, but that much was provided that would allow the reader to infer the required definitions. In contrast, many other economists, in making their definitions precise, make them too rigid. According to student's notes Keynes said:

Marshall, for example, does not make any effort to use his terms precisely, but you always get his meaning from the richness of his context. This is much better than that specious precision which some writers effect, because you are not misled by supposing the term to be precise, and *you must supply the precision from the context and the whole of the thought* (Rymes 1989: 102, my italics).

These observations are truly representative of the mature phase of Keynes' thought. They are connected to those perplexities that, as Keynes writes in the *General Theory*, "most impeded my progress in writing this book" (Keynes 1936: 37): the choice of units, the definition of income and last but not least the part played by expectations in economic analysis.

3.2.2. The *General Theory* and after: Economics as a branch of logic and a moral science

Unlike Marshall's *Principles*, the *General Theory* does not have a chapter devoted to the method in economics. We have to search through Keynes' methodological statements here and there in the book, in his other writings, and in his correspondence of that period. His debates with Harrod and Tinbergen are particularly interesting from this point of view.

Between July and September, 1938, Keynes had an exchange of letters with R. F. Harrod in connection with the latter's "Scope and Method in Economics" (1938). This address provoked "plenty of thought" in Keynes (letter of July 4, in Keynes 1973c). It was the occasion for Keynes to make his mature conception of economics explicit. First of all, Keynes maintains that "economics is a *branch of logic, a way of thinking*" (ibid.: 296). In a successive letter he adds:

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" (letter of July 4, in Keynes 1973c: 297, my italics).

Secondly, Keynes writes:

economics is essentially a moral science and not a natural science. That is to say, it employs introspection and judgements of value (ibid., my italics).

In a following letter (July 10) Keynes emphasises this fact:

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 (ibid.: 300, my italics).

Keynes thinks that economics is “essentially” a moral science. By moral science he meant that economics belongs to those disciplines that deal with human beings in their social environment, i.e. the human sciences. It is not – Keynes emphasises – a natural science, as Robbins had recently argued in his influential *Essay on the nature and significance of economic science* (1935). The reason is that “the material to which it is applied is, in too many respects, not homogeneous through time.” In fact, economics deals with changing and unstable factors like “motives, expectations, psychological uncertainties” in a context of limited knowledge and structural uncertainty. This non-homogeneity through time compels economics to undertake inductive analysis and to take the particular characteristics of the historical world into account. In examining this material, economics uses introspection and value judgements in order to discover the relevant factors needed to build a model or a sample, as Keynes says in his 1933 lectures. Due to the nature of economic material, a complete and exact generalisation is not possible.¹⁴

As a consequence of the fact that economics doesn't give us a complete statement but a sample statement, its way of exposition is quasi-formal. In an early fragment of the preface of the *General Theory*, written around mid-1934, Keynes justifies his way of exposition:

When we write economic theory we write in a quasi-formal style; and there can be no doubt, in spite of these disadvantages, that this is our best available means of conveying our thoughts to one another. But when an economist writes in a quasi-formal style, he is composing neither a document verbally complete and exact .. nor a logically complete proof. Whilst it is his duty to make his premises and his use of terms as clear as he can, he never states all his premises and his definitions are not perfectly clear-cut. He never mentions all the qualifications necessary to his conclusions. He has no means of stating, once and for all, the precise level of abstraction on which he is moving, and he does not move on the same level all the time. *It is, I think, of the essential nature of economic exposition that it gives, not a complete statement, which, even if it were possible, would be prolix and complicated, to the point of obscurity, but a sample statement, so to speak, out of all the things which could be said, intended to suggest to the reader the whole bundle of associated ideas, so that, if he catches the bundle, he will not in the least be confused or impeded by the technical incompleteness of the mere words which the author has written down, taken by themselves.*

This means, on the one hand, that an economic writer requires from his reader much goodwill and intelligence and a large measure of co-operation; and, on the other hand, that there are a thousand futile, yet verbally legitimate, objections which an objector can raise (Keynes 1973b: 469-70, my italics)

¹⁴ Keynes writes in *General Theory*, chapter 18:

Our present object is to discover what determines at any time the national income of a given economic system and (which is almost the same thing) the amount of its employment; which means in a study so complex as economics, in which we cannot hope to make completely accurate generalisations, the factors whose changes mainly determine our quaesitum. Our final task might be to select those variables which can be deliberately controlled or managed by central authority in the kind of system in which we actually live (Keynes 1936: 247)

If “we cannot hope to make completely accurate generalisations” (Keynes 1936: 247), the right language for the construction of the model is not symbolic language but ordinary language, as in Marshall. The reason is:

in ordinary discourse, where we are not blindly manipulating but know all the time what we are doing and what the words mean, we can keep 'at the back of our heads' the necessary reserves and qualifications and the adjustments which we shall have to make later on, in a way in which we cannot keep complicated partial differentials 'at the back' of several pages of algebra which assume that they all vanish (ibid.: 296-8).

Ordinary language seems to be more efficient in handling the complexity of the economy. The essential consequence of this argument is that economic thinking cannot be reduced simply to “blind manipulation”. Keynes writes:

The object of our analysis is, not to provide a machine, or method of *blind manipulation*, which will furnish an infallible answer, but to provide ourselves with *an organised and orderly method of thinking out particular problems*; and, after we have reached a provisional conclusion by isolating the complicating factors one by one, we then have to go back on ourselves and allow, as well as we can, for the probable interactions of the factors among themselves. *This is the nature of economic thinking* (Keynes 1936: 297, our italics).

The construction of the ‘relevant’ model is the key problem. It does not emerge automatically out of empirical study as a result of a blind manipulation of data. The adequacy of the model depends on the ability to select the relevant factors, “the factors whose changes mainly determine our *quaesitum*” (Keynes 1936: 247). The decision which part of concrete reality to incorporate into a model is termed by Keynes ‘judgement of value’. This also makes economics an art because the construction of the relevant model needs the art of introspection in order to study psychic processes, and judgements of value. The model is, in fact, the result of a continuous correction of judgement.¹⁵ The selection of the relevant factors which constitute the model begins with the analysis of facts and facts are what economists must continuously refer to. As Keynes writes in a letter to Harrod of the 10th of July 1938):

¹⁵ An example of the right way of approaching economic problems in the history of economics is, according to Keynes, that of Malthus. He was able "to penetrate these events with understanding by a mixture of intuitive selection and formal principles", "thus to interpret the problem and propose the remedy" (Keynes 1933: 107)

The specialist in the manufacture of models will not be successful unless he is constantly correcting his judgement by *intimate and messy acquaintance with the facts* to which his model has to be applied (Keynes 1973c: 300, my italics)

3.3. Formal generalisation and complexity

3.3.1. The realm of the formally exact: “to disclose gaps and imperfections in your thought”

Economic thinking cannot be simply 'blind manipulation of data'. This is the sense of Keynes' criticism of symbolic pseudo-mathematical methods of formalising a system of economic analysis. He writes:

Too large a proportion of recent 'mathematical' economics are merely concoctions, as imprecise as the initial assumptions they rest on, which allow the author to lose sight of the complexities and interdependencies of the real world in a maze of pretentious and unhelpful symbols (p. 296-8).

Keynes thinks that symbolic methods are not only useful but also necessary tools, but he strongly emphasises that they cannot substitute the economist's judgement. We may refer to the relationship money-prices in chapter 21 of the *General Theory* to show what Keynes means when he writes that generalisations have an *instrumental* role. After discussing the complications of the relation between the quantity of money and price-levels, Keynes tries to express the substance of his discourse in symbolic form. He derives the following expression:

$$e = e_d - (1 - e_w) e_d \cdot e_e e_o$$

where: e = the response of money-prices to changes in the quantity of money

e_d = elasticity of effective demand in response to changes in the quantity of money

e_w = elasticity of wage in response to changes in the effective demand

e_o = elasticity of output in response to changes in the effective demand

e_e = elasticity of employment to changes in the effective demand

"This last expression – Keynes writes - gives us the proportionate change in prices in response to a change in the quantity of money” and “it can be regarded as a generalised statement of the quantity

theory of money" (ibid.: 305). He then introduces his personal reservations about this formal treatment, pointing out the risks of its "blind":

I do not myself attach much value to manipulations of this kind; and I would repeat the warning, which I have given above, that they involve just as much tacit assumption as to what variables are taken as independent (partial differentials being ignored throughout) as does ordinary discourse (ibid.).

He concludes saying that the utility of these methods in his theoretical discourse is "to exhibit the extreme complexity of the relationship between prices and the quantity of money, when we attempt to express it in a formal manner" (ibid.). In his 1933 lectures he had expressed, about the utility of what he calls scholasticism, a really Marshallian opinion:

The effort of trying to be scholastic does disclose gaps and imperfections in your thought, and thus helps to satisfy yourself that your fluffy monster is really pretty good. *The value is to yourself rather than to the reader* (Rhymes 1989: 101-3).

3.3.2. Outside the realm of the formally exact I: the influence of expectations and the business cycle

One of the most important cases discussed in the *General Theory* is that of long-term expectations. Here the characteristics of the non-homogeneity and complexity of the material make it not analysable in a formal way. Expectations are a major issue in the *General Theory* and the recognition of their importance in the behaviour of economic agents is a fundamental contribution of Keynes. Long-term expectation depends on the most probable forecast that the agents can make and on the confidence with which they make that forecast, as Keynes writes in chapter 12. Confidence is defined in terms of "how highly we rate the likelihood of our best forecast turning out quite wrong" (Keynes 1936: 148). Our knowledge of the future is often "fluctuating, vague and uncertain" (Keynes [1937] 1979: 113). In such uncertainty "there is no scientific basis on which to form any calculable probability whatever" (ibid.). In other words, it is not possible to use a probabilistic theory of expectations – such as a rational expectation hypothesis à la Muth (1961), which assumes that expectations correctly identify the mean and variance of stochastic variables affecting future contingencies. On the contrary, in such uncertainty "it is reasonable .. to be guided to a considerable degree by the facts we feel somewhat confident about", because "it would be foolish, in forming our expectations, to attach great weight to matters

which are very uncertain” (ibid.: 148). How do we get around this informative and cognitive shortage? The answer to this question, Keynes maintains, is based on the observation of market and business psychology. In practice - as emerges from this inductive analysis - agents have to fall back on conventional judgement and animal spirits, or, more precisely, to neither ‘rational’ nor ‘irrational’ motives, as Keynes wrote to his former pupil Hugh Townshend¹⁶:

Generally speaking, in making a decision we have before us a large number of alternatives, none of which is demonstrably more “rational” than the others, in the sense that we can arrange in order of merit the sum aggregate of the benefits obtainable from the complete consequences of each. To avoid being in the position of the Buridan’s ass, we fall back, therefore, and necessarily do so, on motives of another kind, which are not “rational” in the sense of being concerned with the evaluation of consequences, but are decided by habit, instinct, preference, desire, will, etc. (Keynes 1979: 294)

Hence the complexity of human behaviour in conditions of structural uncertainty invalidates a formal probabilistic treatment of expectations.

Expectations are very important in business cycle phenomena, which, according to Keynes, are determined by investment. Since expectations and investment cannot be modelled with probabilistic relations, the business cycle is also beyond the domain of probabilistic inference. This is the key reason why Keynes criticised the statistical testing of business cycle theories, like that of Tinbergen (1939). In 1938-39 Keynes had a controversy with Tinbergen over whether statistical methods are the proper tools for testing business cycles theories. The central question raised by Keynes was methodological: “the logic of applying the method of multiple correlation to unanalysed economic material, which we know to be non-homogeneous through time” (Keynes 1973c: 285-6). He concludes that:

“Taking everything into account, the successful application of this method to so enormously complex a problem as the business cycle does strike me as a singularly unpromising project in the present state of our knowledge” (ibid.)

In his 1939 review Keynes specifically raises the problem of passing from statistical description to inductive generalisation. He maintains that:

¹⁶ For an attempt to interpret Keynes' analysis of economic behaviour under uncertainty in the context of bounded rationality theories, see Marchionatti (1999).

the most important condition is that the environment ... should be uniform and homogeneous over a period of time. We cannot be sure that such conditions will persist in the future, even if we find them in the past. But if we find them in the past, we have at any rate some basis for an inductive argument (Keynes 1973c: 316)

He continues:

the main prima facie objection to the application of the method of multiple correlation to complex economic problems lies in the apparent lack of any adequate degree of uniformity in the environment. (ibid.)

According to Keynes, statistics is to be used to test the validity of the model, but this is not feasible in the case of the business cycle, at least “in the present state of our knowledge.” He reasons that a correct prior specification doesn’t seem to be available in the case of a complicated problem like business cycle analysis. The complexity of the material is great. Therefore a positive a priori probability is difficult if not impossible to establish.

3.4. Keynes as a post-Marshallian

Our account of Keynes’ beliefs on the nature of economic thinking and its method has tried to show that Keynes in the 1920s and 1930s flew the flag of Marshall’s credo, which had been lowered by the new mainstream that appeared after the controversy on costs in the 1920s. Keynes accepted the specific criticism of Marshall’s representative firm device and the need to separate statics from dynamics. More generally, he accepted the need to abandon Marshall’s idea of the continuity of different stages of reality as analysed by the economist. At the same time, he strongly emphasised the characteristics of economic material, which makes economics a moral science and a science of thinking in terms of models. This forces the economist to use introspection and judgement of value, constantly corrected by “intimate and messy acquaintance with the facts to which his model is applied”. The economist is often forced to write in a quasi-formal style. This methodological strategy of research has its core in the logical question – is it correct to apply a certain method to a certain specific problem? It is the natural opposite of the method of ‘blind manipulation’, as Keynes called it. In this sense Keynes takes up Marshall’s message of economics as a science of complexity, but carries it beyond Marshall’s impasse.

4. Coming back from the visit to the lumber room. Concluding remarks

We are now able to briefly consider the two questions raised in the introduction: a) was there a common ground in Marshall and Keynes on the nature of economic thinking ? b) are Marshall and Keynes old-fashioned economists ?

The answer to the first question is positive. Both Marshall and Keynes developed a conception of economics as a science that attempts to deal with complexity using several tools. Both saw a limited scope for the fruitful use of mathematics in economics. Both had a reasonable preference for a discursive and context-based style of exposition. Both considered the role of subjective judgement and intuition crucial for identifying the correct model and its implications. Keynes' mature position of the 1930s was the result of a thinking influenced by his reflection on the theory of probability as well as Marshall's lesson. By emphasising the idea of economics as a science of thinking in terms of samples or models without aspiring to generalisations to cover everything - as Marshall did with his successive approximation approach of Book V of the *Principles* -, Keynes overcomes his predecessor's impasse.

Regarding the second question, we can first maintain that the reasons why Marshall and Keynes may be seen as 'old-fashioned economists' are not the result of a bounded methodological awareness and ignorance of formal techniques, as supposed by contemporary critics. On the contrary, they come out of a reflection on the peculiarity of economic material and the possibility of dealing with it using formal treatments.

But are their doubts, criticisms, their preference for a quasi-formal style, and their invitation to prudence in the use of mathematical formalisation of any significance today ? The answer to this question requires some considerations on the most recent developments of economics.

Certainly today, as in Marshall's and Keynes' times, the traditional mathematical approach in economics based on linearity and systems of differential equations seems not to be the best way to understand complex situations such as those today called adaptive non-linear networks (Arthur, Durlauf and Lane 1997), which are characterised by interactions between heterogeneous agents with limited cognitive resources who revise continually their behaviour as they accumulate experience, and innovate. Non-linear dynamic approaches to cope with these complexities have recently emerged. They use techniques that have made it possible to explore the consequences of relatively complex systems in a way which was never possible before. They have been successfully applied to examine such phenomena as speculative bubbles and path dependence in various contexts. (For a survey, see

Barkley-Rosser 1999). As regards the topic of this paper, these approaches confirm two important points which were raised here. First, the continuity hypothesis is not effective. In fact, gradual changes (in the degree of interaction, for example) can lead to discontinuous changes. Secondly, the dynamical behaviour of even simple economic systems is surprisingly complex (Saari 1995). The emphasis on the existence of complications in treating economic problems confirms that Keynes was probably right in warning economists not to fall into the 'blind manipulation mechanism' and not to react to difficulties as Tinbergen did, according to Keynes, that is engaging "another ten computers and down his sorrows in arithmetic" (Keynes 1939). Today the risk of acting like this is – after having abandoned the simple but certain field of the principles of mainstream economics – that we may create a great number of special cases among which nobody can reasonably choose. On the contrary the issue is, as Keynes emphasised, our ability to select the relevant factors in the economic system “in which we actually live” and to thereby construct the *relevant* model.

In conclusion let us summarise the most relevant points of a Marshall-Keynes methodological agenda in order to analyse complex economic systems:

- firstly, mathematics is the correct approach *only when* it is coherent with the properties of the system to be analysed;
- secondly, the search for general results that hold for all times and every situation - exact generalisations to cover everything - is a '*chimera*';
- thirdly, the quasi-formal style of exposition is *often* the most appropriate one: it is intended to suggest "the whole bundle of associated ideas";
- fourthly, a mixture of intuition, judgements of value and analytical ability - trained common sense - is required for dealing with complexity in economics; the ability to constantly amalgamate "*logic and intuition and wide knowledge of facts*" is the crucial factor in economic interpretation.

In the light of the evolution of economics in the Twentieth Century, it seems that Marshall's and Keynes' old-style agenda is not out-of-date for the economists of the Twenty-First century. Their methodological reflections and warnings can be help us when we look for - as many contemporary economists do – more and more satisfying answers to the question of the analysis of complex situations out of the schemes of mainstream economics. In any case, their reflections certainly represent a challenge for the economists who indulge themselves in the opinion that spending time discussing logical questions on the propriety of the tools they use for their purposes is scarcely interesting. Paradoxically these economists are the very ones who are running the risk of being the really old-fashioned actors on the scene of contemporary economics.

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