

Volume 9, Issue 1, 2020

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The Two Blades of Occam's Razor in Economics: Logical and Heuristic

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Abstract

This paper is part of the general debate about the need to rethink economics as a human discipline using a heuristic to describe its object, about the need to explicitly reject the positivistic approach in neoclassical economics, and about the urgency to adopt a different methodology, grounded on a realistic set of initial assumptions able to cope with the complexity of the decision making process. The aim of this paper is to show the use of Occam's razor in the economic debate around realism in economic modelling. Occam's razor can be intended as a principle of logic that emphasises simplicity, or as a heuristic tool that emphasises parsimony. Neoclassical economists, such as Samuelson, have explicitly used Occam's razor as a logical principle to highlight the strict logic and simplicity of neoclassical economics; neoclassical models, however, are based on unrealistic assumptions. Some approaches of heterodox economics, *au contraire*, have used Occam's razor as a powerful heuristic tool to emphasise parsimony, building up models grounded on realistic initial assumptions and capable of embedding complexity into the general explanation of economic behaviour, as in Simon's bounded rationality (1955; 1957) and Hayek's notion of human rationality (1948; 1952; 1974) and cultural and social evolution (1967; 1978).

Keywords: logical principle, reasoning heuristic, complexity, realism, models

JEL codes: B41, B53

Introduction

Occam's razor was formulated during the Middle Ages by *Doctor Invincibilis*, alias William of Occam (circa 1290-1349). Occam's razor states that of two competing theories, the simpler and more parsimonious is preferred. It derives from a more general application of Occam's philosophical outlook (according to which any knowledge is supposed to be grounded *only* on experience), and on a complete rejection of any traditional aspect of Aristotelian metaphysics (upon which traditional Scholastics had been developed). Simplicity (*entia non sunt multiplicanda praeter necessitate*, which means 'entities are not to be multiplied beyond necessity') and parsimony (*frustra fit per plura quod potest fieri per pauciora*, which means 'in vain is that explained by many things which can be explained by fewer things') are the two blades of Occam's razor.

Although simplicity and parsimony are related, they are not the same: simplicity is related to the capacity of a model to describe a complex phenomenon in a 'sophisticatedly simple way' (Zellner, 2001; 242); parsimony is 'a proper subset of simplicity' and it involves a paucity of factors (Jensen, 2001; 283). Hence, Occam's razor can be defined as follows: 'the widely held principle of science that the simplest (often shortest) explanation that is adequate

in number and type of assumptions (simplicity) and in technique (elegance) to explain the observed facts is the criterion by which to prefer explanations' (Reid, 1987, 551n).

Because Occam's razor advocates simplicity and parsimony, it influenced many philosophers and has been considered the most suitable tool to explain and predict phenomena not only in physics¹ but also in other fields, including economics. Hicks (1938) first introduced Occam's razor into economics, in terms of parsimony, to exclude the measurability of consumer utility (Pfouts, 2002). Samuelson (1947) and Friedman (1953) gave precedence to simplicity in their economic modelling.

In this paper I consider the two blades of Occam's razor – simplicity and parsimony – as the tools adopted respectively by neoclassical economics and by heterodox economics. Simplicity is the capacity to reduce complexity in building up a model, while parsimony is the capacity to reduce the number of factors included in a model. While simplicity emphasises logic, parsimony emphasises heuristic. By complexity is meant a non-equilibrium view of the economy, where actions and strategies constantly evolve (Arthur, 2014). Heuristic is intended as a specific feature of human behaviour under certain circumstances when agents adopt mental shortcuts in order to make decisions faster and more frugally (Gigerenzer and Todd, 1999).²

The use of the first blade of Occam's razor implies a trade-off between simplicity and realism: a simpler model is more logical, but less realistic.³ The lack of realism has two sources: the concept of the agent as *homo oeconomicus*, and the lack of structure – that is those institutions which promote methodological and ontological individualism. Conversely the use of the second blade of Occam's razor increases realism: parsimony reduces the number of factors included in a model by adopting only factors that are real.⁴

Let's consider the nature of rationality, as an application of the two blades of Occam's razor by neoclassical economics and heterodox economics respectively. On one side, neoclassical economics adopts full rationality in the name of simplicity (as in Friedman's *as if* assumption, see section 1). This adoption of full rationality implies an infinite amount of information as *if* it was available to agents and it implies a capacity by agents to handle that information. This process is logical but it is neither parsimonious (because the amount of information is infinite) nor realistic (because no agent is capable of acquiring or processing an infinite amount of information). On the other side, heterodox economics adopts bounded or

¹ Leibnitz and Newton used Occam's razor to drop any metaphysical residual from science. During the last century, Mach's principle of 'the economy of science' unified the methodology of Occam's razor along with the idea of an economy of nature, according to which nature is an organised and frugal system (Mach, 1960[1883]). Mach's formulation reinforced the pure theoretical principle of simplicity with the more operative principle of parsimony, according to the Occam's razor tradition. During the 1920s, the revival of Occam's razor had particularly taken place in European continental philosophy, especially in Schlick's circle (Vienna) as well as in Reichenbach's group (Berlin).

² As Peter Cserne suggested in his comments on this paper, there is an ambiguity in defining heuristic as a methodological rule of thumb, as it is possible to apply the notion of 'rule of thumb' either to economic agents' decisions or to researchers developing theories. According to Cserne, this ambiguity may be partially resolved by describing theory building as a special case of human decision-making.

³ A caveat on realism: as Mäki pointed out, scientific realism is not a uniform doctrine: 'while economists use the term "realism" to refer to a presumed property of theories, philosophers use it to denote a theory of theories'. Hence, Mäki suggested that 'realism', as used by economists, should be replaced by 'realisticness', i.e. 'a property of theoretical representations as adopted by economists and philosophers of economics' (Mäki, 1998a, p. 304). While I agree with Mäki's distinction, I do prefer to use the term 'realism' in this paper, as it is accepted by scholars of both disciplines. I owe this caveat to Fleetwood's comment of this paper.

⁴ Hirschman (1984) gave an alternative interpretation of 'parsimony': he identified parsimony with the abstraction of rational choice theory. According to Hirschman "[the] *parsimonious* postulate: that of the self-interested, isolated individual who chooses freely and rationally between alternative courses of action after computing their prospective costs and benefits" (p. 11) presumes to explain even noneconomic phenomena, such as family and crime. Hirschman was implicitly criticising Becker's notion of human economic behaviour (Becker, 1976).

limited rationality and heuristic in the name of parsimony (as in Simon or Hayek, see section 2). The notion of bounded/limited rationality reduces the quantity of information available and forces economic agents to adopt a heuristic in order to make a decision, as opposed to maximising an expected utility function as logic demands. This process is parsimonious (the amount of information is less than in the previous model) and more realistic (a heuristic, such as rule of thumb, is *de facto* adopted by agents to make a decision).

Let's consider the nature of 'economics as a science' as another example of the application of the two blades of Occam's razor by neoclassical economics and by heterodox economics (see section 1 and 2). On one side, the use of the logical blade (=simplicity), adopted by Samuelson, Friedman and neoclassical economists, reduces economics (the science which describes economic individual and social behaviour) to physics (the science which describes nature). This operation is 'meaningful' (in Samuelson's terms) because it reduces complexity, i.e. it makes it simpler to describe economic phenomena if we consider decision makers as *if* they were atoms following natural laws, like decreasing marginal utility. A trade-off between simplicity and realism emerges again when economic agents, either individual or social, are compared with physical atoms. On the opposite side, the use of the heuristic blade (=parsimony) adopted by heterodox economics, increases realism by avoiding the conflation of economics and physics.

It is as a logical principle that gives precedence to simplicity that Occam's razor has been used in neoclassical economics and econometrics. We can see this in Samuelson's revealed preference theory, Friedman's concept of positive economics and Becker's model of the consumer (Wong, 2006). In econometrics, Keuzenkamp and McAleer (1995) explicitly used Occam's razor to develop simple models; those models, however, are not parsimonious, because parsimony implies an insufficient number of parameters. In using Occam's razor as a pure logical tool, one that gives precedence to the simplicity of a model, neoclassical economics incurs a fault: it neglects the reality that in the human sciences a trade-off exists between simplicity and realism, and this trade-off cannot be confused with the degree of abstraction that characterises the object of any natural science, like physics, because human behaviour cannot be compared with the behaviour of, say, atoms.

It is as a heuristic that puts emphasis on parsimony that Occam's razor has been used by heterodox economists, invoking a rule of thumb. Examples are Simon's bounded rationality and Hayek's approach to complex phenomena. In using Occam's razor as a heuristic tool, heterodox economics leverages an advantage: it permits a more realistic description of individual behaviour (under whatever constraint) because it implies the adoption of a rule of thumb (based on a realistic scenario in which individuals are not fully rational maximisers). The advantages of using Occam's razor as a heuristic rule of thumb is that it allows economists to develop their theories in a way that does justice to, rather than assumes away, the complexity of their subject matter, as in the case of Simon's bounded rationality and Hayek's theory of the social world and complex phenomena.

1. Neoclassical economics' adoption of Occam's razor simplicity blade: the role of logic

Neoclassical economics, which became the mainstream within the discipline in the mid-1950s (Colander, 2000; Dequech, 2007), had intended Occam razor's as a pure logical principle. The success (in the sense of becoming mainstream) of a paradigm (neoclassical economics) has many reasons behind it. It has been often remarked how neoclassical economics had formally reached a cognitive status as well as a scientific respectability due to the general agreement around neoclassical results, focused on general economic equilibrium and rational

choice theory (Weintraub, 2007). Both general economic equilibrium and rational choice theory adopt a set of initial methodological assumptions that are 'occamite', when Occam's razor is intended in a pure logical sense. The assumptions are the simplest possible (an economic agent is able to rank her preferences, which are transitive, complete and technically convex) and suggest a unique way of reasoning (given a budget constraint, a utility function is expected to be maximised in order to achieve the optimum).

Occam's razor logical blade is fashionable in neoclassical economics because it becomes the essential route towards elucidating a simpler description of individual and social dynamics in order to explain economic phenomena, albeit simpler does not always mean clearer. Furthermore, Occam's razor logical blade matches the urgency to express models⁵ as well as initial assumptions in mathematical terms. The advantage of using a formal language is twofold: it avoids any possible linguistic misunderstanding,⁶ and it makes explanations as simple as they can be.

The immediate example of the application of such a scheme within the natural sciences is physics. In fact, neoclassical economists have modelled the discipline on physics in order to become a *positive* science. The process of modelling economics as physics started with the rise of marginalism (at the end of the 19th century) and continued until the final systematisation of general economic equilibrium (in the 1930s through the 1950s), ultimately becoming the dominant style of neoclassical economics within the mainstream (Weintraub, 1985; Mirowski, 1989; 2002; Lawson, 2013). According to Mirowski (1989), it was Fisher who first tried to apply physics to economics, without understanding the differences between their domains, and, according to Boumans (1993), it was Tinbergen who introduced the concept of 'formal analogies' between physics and economics without drawing any substantial analogy between their domains.⁷

Why do physicists and neoclassical economists consider simplicity (the logic blade of Occam's razor) the best way to develop a theory? The answer seems immediately apparent: because in a simpler framework, mistakes are reduced. Although both physicists and neoclassical economists are aware that making Occam's razor operational in a non-arbitrary way can be difficult, they accept Occam's razor as a logical principle because it makes it easier to match theoretical knowledge with actual behaviour (as in Mach's economic principle of the economy of science).⁸

The analogy between physics and neoclassical economics is fundamental in the history of the discipline: in Samuelson's *Foundations*, this analogy has been modelled on the assumption that both physical and economic phenomena can be described and explained in the same terms. Both are in fact based on the existence of *operationally meaningful* theorems as well as on 'the existence of a general theory which underlies the particular theories and unifies them with respect to those central features' (Samuelson, 1947, 3). By a *meaningful theorem*, Samuelson means 'simply a hypothesis about empirical data which could conceivably be refuted, if only under ideal conditions' (Samuelson, 1947, 4), and by 'operational' he means a theorem that can be empirically tested. According to Samuelson, 'meaningful theorems exist in economics and they proceed from two hypotheses: any

⁵ Given the ambiguity of the term 'model', I will be following Mäki's definition of models as representations of some target or as surrogate systems (Mäki, 2009a).

⁶ However it may create its own misunderstanding, of a non-linguistic variety.

⁷ Even though the introduction of models in economics has reduced the naturalism of the discipline (Sugden, 2000; Morgan, 2012; Mäki, 2013), philosophers such as Cartwright (1999) defined economics' attitude to consider itself as a natural science, by following an 'imperialistic tendency', bound to fall into the trap of methodological fundamentalism.

⁸ The use of Occam's razor purely as a logical tool causes many other problems: for instance, what is the best way to measure simplicity, or how simplicity and empirical models are reciprocally related (Zellner et al., 2001).

equilibrium is a result of a process of maximisation (minimisation), and the stability of equilibrium' (Samuelson, 1947, p. 5).⁹

Along with Samuelson's modelling economics as a physical science, there is Friedman's modelling economics as a positive science. Friedman defined positive economics as 'an objective science, in the same sense as any of the physical sciences' (Friedman, 1953, p. 4);¹⁰ and behind Samuelson's and Friedman's neoclassical economics there is the emergence of rational choice theory, i.e., the transformation of individuals into economic agents whose behaviour can be reduced to uniformity, just as can the behaviour of physical atoms.

This process is made possible by the introduction of an axiomatic system to describe human preferences and of a mathematical language to describe human utility in order to explain individual decision making (including any decision making under uncertainty) as cohesive. In fact, from a methodological point of view, Samuelson approaches Friedman in considering the instrumental role of theory in maximising behaviour in building up economic models of equilibrium. Samuelson wrote:

'In cases where the equilibrium values of our variable can be regarded as the solutions of an *extremum* (maximum or minimum) problem, it is often possible regardless of the number of variables involved to determine unambiguously the qualitative behaviour of our solution values in respect to changes of parameters (...). It is possible to derive operationally meaningful restrictive hypotheses in consumers' behaviour so as to maximise an ordinal preference scale of quantities of consumption goods and services' (Samuelson 1947, pp. 21-22).

The microeconomic process of maximising expected utility functions combines individual dynamics with the static stability of the final equilibrium in the economic system, as happens in physics. This interpretation describes the logic mechanism of the economic system as if it determined the logic of the economic maximising agent (Davis, 2003).

By adopting Occam's razor as a purely logical tool that gives precedence to simplicity, neoclassical economists are able to model economics as a physical and positive science. In order to make this theoretical operation possible, some fundamentals (listed below) have been accepted by neoclassical economists, and they form the pillars of neoclassical economics:

⁹ In his epistemic position, Samuelson was influenced by Bridgman's operationalism in physics and by early logical positivism: 'his view of scientific theories [was] *descriptivist*: scientific theories merely describe the empirical evidence and do not go beyond the evidence to *explain* any deeper, underlying, or hidden causes of the phenomena' (Hands, 2001, p. 63).

¹⁰ Friedman's positive economics stands in contrast to normative economics as it implies the independence of economics from any particular ethical position or normative judgment (Friedman, 1953, p. 4). As this process developed, ethics was discarded from economics, as it diverged further from the other social science (Sen, 1987; Putnam, 2002). For a recent debate on the relationship between ethics and economics, see De Martino and McCloskey et al. (2016). Nevertheless, many scholars consider fictitious the distinction between positive and normative economics: 'a modernist chimera founded on the rigid dogmas of positivism, the total structure of neoclassical economics is normative in nature on account of the special role it ascribes to the postulate of rationality and the fact that the theorist must necessarily invoke non-cognitive mental notions which he or she must interpret in subjectivist and evaluative terms' (Keita, 1997, p. 82).

- a. An axiomatic set of prerequisites (the proprieties of individual preferences) described by a mathematical language;¹¹
- b. A specific role for causality (economic relations usually depend on personal expectations);¹²
- c. Formal models that are considered able to describe the real world (general economic equilibrium model took a Bourbakian approach);¹³
- d. The use of microeconomics to explain aggregate phenomena intended as a method of making aggregations by assuming that the actions of individuals are the outcomes of optimising decision-making processes, and that equilibrium is the final outcome.¹⁴

These fundamentals, however, show that neoclassical economics rests on **hypotheses** and **assumptions** that are not just simple (in terms of Occam's razor) but oversimplified and inconsistent with reality.¹⁵ Furthermore, their simplicity becomes apparent and is misleading (this would be an example where Occam's razor retards rather than enhances economic knowledge (Reid, 1987)). In fact, economic agents, as well as social aggregates, do not follow linear paths of behaviour: hence, the completeness, symmetry, reflexivity and transitivity axioms of preferences can be violated, as has been demonstrated in different ways (Allais, 1953; Kahneman and Tversky, 1981). Furthermore, the transition from a description of individual economic behaviour to a description of complex social groups is fallacious, because it is based on the idea that complex systems are simply the sum of their single components (individuals), which is not valid (Albin and Foley, 1998; Israel, 2005). In describing social behaviour, the theory of expectations can be a guideline for economists (Lucas and Sargent, 1981), but it does not guarantee a correct and robust economic forecast (Davidson, 1982). Moreover, the lack of realism in neoclassical economics is one of its main faults that reduce the complexity of *explananda* and the possibility of moving closer to a proper explanation (Hodgson, 2004);

The *lack of realism* (or *realisticness* as a property of models¹⁶) in neoclassical economics' initial assumptions and the way they are adopted to *reduce complexity* in describing decision making processes are two interconnected aspects of neoclassical economics and thus have to be analysed as related, in order to understand how they make neoclassical economics problematic in terms of a proper description of economic behaviour.

To be concerned about the realism of a theory implies a concern about the degree to which models represent and resemble the chunks of the real world they seek to engage with, as well as between theoretical assumptions and empirical models (based entirely on data). The collection of data is the very first methodological issue in constructing any empirical model: relevant data serve to test or calibrate models (Knuutila, 2009; Morgan, 2001). These

¹¹ Rational choice theory is grounded on the axioms of consumer preference that has been modelled with the aim of allowing a mathematical interpretation of utility functions, of portraying rational behaviour as optimal, and of deriving proper demand curves.

¹² Rational choice theory models individual expectations, which may be adaptive and rational, in a way that implies a direct and simple behaviour: the economising behaviour of maximisation.

¹³ Although at a certain point, neoclassical economists rejected the use of physics to explain formal models, like general economic equilibrium, in favour of pure bourbakian mathematics (Giocoli, 2003), as in the case of Debreu (Weintraub, 2002).

¹⁴ Macroeconomics is reduced to microeconomic analysis: macroeconomic phenomena can be explained by deriving them from microeconomics parameters, such as individual preferences and expectations. For a critical view on this methodological reductionism see Hoover (2001; 2010) and King (2012).

¹⁵ For some scholars, this is enough to consider it as a form of powerful rhetorical discourse (Nelson 2001; Mitchell, 2016), and for some scholars of other disciplines as a pseudo-science (Patterson and Fosse, 2015).

¹⁶ See footnote 3.

models are able to make hypotheses testable, problem solving and prediction being the two main aims of science. Scientists and scholars of social disciplines are 'empirical modellers... making logical inferences based on data, to understand what is going on and what will happen' (Thompson, 2011, p. 1). The lack of realism, which remains the main fault of neoclassical economics from a methodological point of view,¹⁷ became explicit in Friedman's 1953 definition of positive economics, where the concordance between a theory's predictions and observed phenomena is the only thing that matters.¹⁸ In fact, Friedman said, a discourse on 'unrealism' is pointless, and theory can only yield predictions that are good approximations; furthermore, assumptions cannot test an economic theory, because they are ambiguous, and a criticism based on the discrepancy between assumptions and the real world is rooted in 'the confusion between descriptive accuracy and analytical relevance' (Friedman, 1953, p. 33). Friedman's conclusion is his well-known *as-if* principle:

'it is frequently convenient to present such a hypothesis by stating that the phenomena it is desired to predict behave in the world of observation *as if* they occurred in a hypothetical and highly simplified world containing only the forces that the hypothesis asserts to be important' (Friedman, 1953, p. 40).¹⁹

Although recently Friedman's anti-realism has been reconsidered (Hoover, 2009; Mäki, 2009),²⁰ his methodology has been overtly criticised since its publication (Hausman, 1992b, Gul and Pesendorfer, 2008; Gilboa, 2009; Mäki, 2011). Ernst Nagel's critique of Friedman's methodology is based on the fact that Friedman failed to distinguish between three kinds of 'unrealism': the lack of an 'exhaustive' description; the possible accordance between an unrealistic assumption and a correct theory; and the instrumental use of unrealistic assumptions when they reveal discrepancies between pure theory and described phenomena (Nagel, 1963).²¹

The critique of Friedman's methodology – the so-called Friedman's *as-if*, or Friedman's twist, as Samuelson stigmatised it – 'has paved the way for an internal debate in economics around the falsifiability of a theory, and the possibility to develop a theory of empirical contest as well as to provide testable axioms for describing individual behaviour' (Chambers, Enchenique and Shmaya, 2014). In Samuelson's words, 'F-twist is fundamentally wrong, in thinking that unrealism in the sense of factual inaccuracy even to a tolerable degree

¹⁷ Robert Lucas, for example, claimed that the insistence of realism damages the scientific aspects of economics (Lucas, 1981).

¹⁸ Friedman's essays, and particular Chapter I on methodology, have been called 'the most cited, the most influential, the most controversial piece[s] of methodological writing in twentieth century economics' (Mäki, 2009c, p. xvii), and 'a marketing masterpiece' (Caldwell, 1982, p. 173).

¹⁹ Blaug's well-known battle for a realistic methodology of economics (1992), based on a falsificationist critique of both mainstream and heterodox economics, led him to a normative approach mainly as a result of 'meta-theoretical claims about economics often descriptively unrealistic' (Mäki, 2013a, p. 89). It was Hutchison (1938) who introduced Popper's falsification principle (Popper, 1959[1935]) into economics, as an attack on Mises' apriorism (Hands, 2001). For an extensive consideration of the problem of demarcation in economics, see Latsis at al. (1976) and Mäki (2008). For a historical reconstruction of the legacy of Friedman's principle within economics, see Mäki (2009b), and Mayer (2009).

²⁰ For a more complex and recent analysis of Friedman's *as-if* principle, see Mäki at al. (2009).

²¹ A discourse about the realism of initial assumptions in economics, and more generally within the social sciences, should take account of the distinction between abstraction (the process of focusing on a particular aspect of a phenomenon to build up a model able to explain it) and idealisation (the tendency to isolate an economic phenomenon as if it worked without any external interference). They are independent methods of reasoning. In the process of idealisation, a distinction between internal validity (the correct use of data) and external validity (the actual degree of generalisability) should be made in order to test a model (Rol, 2008). According to Runde (1997), neoclassical economics adopts idealisations to facilitate the application of a deductive method.

of approximation is anything but a demerit for a theory or hypothesis (or set of hypotheses)' (Samuelson, 1966, p. 1774). Samuelson's position against Friedman's methodological approach has been criticised by Machlup, who, referring to Samuelson's '*operationally meaningful* theorems' (mentioned before), claimed that the best results of Samuelson, as a theorist, are deduced from unrealistic assumptions: 'Samuelson produces his best work when he deduces from unrealistic assumptions general theoretical propositions' (Machlup, 1964, p. 735).

Unlike Friedman, Samuelson claimed that the realism of assumptions matters and introduced the so-called Samuelson's razor valid for both physics and economics (Samuelson, 1966). In Samuelson's reply to Machlup, he reminded the latter that his doctrine of revealed preference is grounded in realism, and he explicitly mentioned Occam's razor as a 'primarily aesthetic' tool to criticise unrealistic assumptions in science; Samuelson used Occam's razor's logical blade to justify his position: 'Occam's razor has cut away every zipper, collar, shirt, and fig leaf' (Samuelson, 1964, p. 738).

A possible explanation for Samuelson's use of Occam's razor purely as a logical tool can be found in the fact that, as Hands clarifies, he (along with Friedman and Hutchison) was influenced by positivist ideas:

'[Friedman's] purposes of positive (as opposed to normative) economics, *the truth of the assumptions of a theory do not matter at all*, [because] the only thing that matters in deciding among various economic theories is which one is most successful in making empirical *predictions*. The Theory that makes the most accurate predictions in the relevant domain is the best theory, and if it employs "unrealistic" assumptions this should not in any way detract from its success as a positive scientific theory. (...) [In] Samuelson's methodological position, scientific theories *merely describe* the empirical evidence and do not go beyond the evidence to *explain* any deeper, underlying, or hidden causes of the phenomena. On this view, science can indeed provide explanations, but such explanations are independent of the cognitive content of the scientific theories involved (...) such descriptivism was representative of early (but not later) logical positivism' (Hands 2001, pp. 54-63).

They were still embedded in the cultural framework of economic positivism, i.e., the application of positivist methodology to economics (Wilber and Wisman, 1975), and the promotion of neoclassical economics as the only scientific approach to explain individual and social behaviour in economic model building (Boland, 2003). Although 'economic positivism' has different nuances, and can be very confusing, the idea of 'positive economics is mostly a matter of rhetoric' (Boland, 1997, p. 117), and Occam's razor's power of rhetoric is highly enlightening.

Let us now turn to the other aspect of economics with which the lack of realism is connected: the reduction of complexity. In neoclassical economics, the reduction of complexity started with the introduction of *homo oeconomicus*, a rational maximiser of a utility function, and it continued with the application of individualism to describe social institutions. This process led to rational choice theory, focused on the methodological assumption that individuals are rational economic agents able to rank their preferences and, given a budget constraint, choose the optimal solution. The story of rational choice theory began with Pareto's concept of revealed preferences, later developed by Samuelson's revealed preference axioms (Mas-Colell, 1978), and it finally ended up with Becker's economic

approach to human behaviour as the combination of 'maximising behaviour, market equilibrium and stable preferences' (Becker, 1976, p. 7). Rational choice theory was dominant in the discipline from the 1950s, with Friedman-Samuelson's systematisation, up to the 1990s, when some alternative theories were advanced without successfully replacing it (Moscati, 2016).

Rational choice theory uses an 'oversimplified pattern of human behaviour [that] ignores the irreducibility of wants (...) the background for unpredictable results is reduced to probability' (Georgescu-Roegen, 1954, p. 531). Rosenberg has defined the neoclassical reduction of complexity in describing economic behaviour as a 'formalised folk psychology' based on subjectivism and preferences, which fails to define the real causes of individual behaviour (Rosenberg, 1992). Under strict rationality, the complex problems associated with the acquisition of human knowledge are reduced and oversimplified in the automatism of human behaviour (reduced to maximisation of an expected utility function).

Summing up, neoclassical economics, grounded on 'operationally meaningful hypotheses' (*à la* Samuelson), on the notion of positive economics (*à la* Friedman), and on economic agents depicted as fully rational Bayesian maximisers of subjective utility, does not explain the *complexity* of human actions in a *realistic* way. In Buchanan's words:

'The *subjective* elements of our discipline are defined precisely within the boundaries between the positive, predictive science of the orthodox model (...) The recognition of the domain of an operationally meaningful economic theory does not carry with it any implication concerning the practical usefulness of this theory in making predictions in the real world' (Buchanan 1982, pp. 8-16).

2. Heterodox economics' adoption of Occam's razor parsimony blade: the role of heuristic

The common intent of many so-called heterodox approaches to economics is to work towards a major revision of neoclassical methodological assumptions and to open up alternative theoretical perspectives able to consider, in a more realistic way, the interconnection between individual dynamics and social phenomena. Recently, some heterodox economists used heuristics in a serious attempt to separate themselves from the neoclassical model of economic rationality: unlike neoclassical economics, they adopt Occam's razor as a heuristic rule of thumb and accuse neoclassical economists of applying a mathematical-deductive method to a series of inappropriate (unrealistic) conditions, such as using individual preference axioms in a static context. In such a context, heterodox approaches consider the lack of realism in neoclassical economics as the most severe limitation within the discipline, and they introduce alternative models, such as rhetoric, persuasion, metaphors, and heuristics (McCloskey, 1983; Lawson, 1997; Mäki, 1998b; 2012; Hausman, 1998; Gigerenzer, 2008; Gigerenzer and Todd, 1999; Keen, 2001; Lewis et al., 2004; Lavoie, 2014).

In the previous section we have just considered some faults of neoclassical economics with regard to Occam's razor logical blade. But what about the advantages of using Occam's razor heuristic blade in economics? Advantages are mainly focused on the possibility of building up a coherent and realistic theory of human behaviour and economic dynamics in social terms. As Simon recalled:

'Occam's razor has a double edge. Succinctness of statement is not the only measure of a theory's simplicity. Occam understood his rule as

recommending theories that make no more assumptions than necessary to account for the phenomena. A theory of profit or utility maximisation can be stated more briefly than a satisficing theory, but the former makes much stronger assumptions than the latter about the human cognitive system. Hence in the case before us, the two edges of the razor cut in opposite ways' (Simon 1992, pp. 345-346).

To describe economic behaviour in the most realistic and coherent way, Occam's razor has to be adopted as a heuristic rule of thumb (Lauth, 1997; Burgess, 1998), which gives precedence to parsimony rather than to simplicity. This will allow economists to better explain the complexity of the object of economics (individual and social dynamics within a specific context) and to reach a more realistic *explanation* (the causal inference and the connected relations between means and ends in individual and social dynamics) of its own *explanandum* (the object of economics). In fact, the object of economics is complex, and individual decision making, as well as social dynamics, do not, I argue, necessarily follow the strict regularities imposed by neoclassical economics, as social dynamics are not simply the sum of individual dynamics as implicitly asserted by neoclassical economics.

Against neoclassical economics, which reduces the complexity of its *explanandum* (economic behaviour) and loses realism as a result, Hayek retains the complexity of the *explanandum* and stresses the importance of reducing any lack of realism. The following passage, quoted from Hayek, illustrates this point:

'[Model building] brings out an important feature which all explanations possess but to very different degrees. (...) To the physicist the value of a model (especially of a mathematical model represented by a set of equations) normally consists in the fact that he can ascertain and insert the relevant variables and thus derive the quantitative values of the events to be predicted or explained. Yet in [social sciences] similar models are regularly used although the values of the variables cannot in fact be ascertained. (...) The service of a theory [within the realm of social sciences] would perhaps be better described by the term *orientation* than by speaking of prediction. Although such a theory does not tell us precisely what to expect, it will still make the world around us a more familiar world in which we can move with greater confidence' (Hayek, 1967, p. 18).

Occam's razor, intended as a heuristic tool, has at least two advantages: it makes it possible to produce realistic models describing human behaviour and social phenomena,²² and it provides an easy procedure for problem solving, based on practical experience, one that does not guarantee an optimal solution, but one that can nevertheless provide a satisfactory one in an uncertain context.²³ An important turning point in establishing the advantages of Occam's razor as a heuristic device capable of providing a realistic description of economic behaviour as well as economic phenomena was Simon's model of bounded rationality, based on the

²² As in Lawson's distinction between agency and structure intended as two dimensions of social reality that condition one other (Lawson, 2013).

²³ As Karl Menger, the mathematician son of Carl the economist, had claimed about the use of Occam's razor in social science modelling: '*It is vain to try to do with less what requires more.* This more general formulation of the counterpart of Occam's law, besides denouncing ontological gaps, may also be construed as a semantic maxim opposing equivocations. (...) Under certain circumstances, the methodological tool that is needed is not a razor but a prism resolving conceptual medleys into the spectra of their meanings or, if one wishes to remain in the torsorial domain of the razor, a comb disentangling and straightening out the various threads of thought' (Menger, 1961, p. 332).

satisficing principle rather than maximising behaviour (Simon 1955; p. 1957). According to Simon, 'human beings have reasons for what they do, but they seldom maximise utility, (...) given the complexities and uncertainties of the choice situations they face' (Simon, 2001, p. 57). Although Simon did not explicitly consider the choice of parsimony over simplicity as a superior criterion, neither did he talk about realism,²⁴ I consider his critique of neoclassical economics' modelling of economic behaviour as an implicit application of the heuristic blade of Occam's razor, focused on parsimony. If we intend satisficing as a humanly rational strategy, it appears simpler and more frugal than maximising because in this scenario, individuals are following a rule of thumb in a dynamic context; while in the neoclassical scenario, individuals are optimisers in a static and non-realistic context of perfect knowledge and complete information. To seek optima is not a reasonable strategy, because finding optima requires unrealistic assumptions in formal modelling.²⁵

In this context, Gigerenzer's notion of a 'fast and frugal' heuristic is one of the best examples of an 'occamite' approach, based on parsimony, in explaining the decision making process (Gigerenzer and Selten, 2001): a fast heuristic requires only a short time to solve a problem, and a frugal heuristic solves a problem with the information actually available (Gigerenzer, 2008). In terms of Occam's razor, neoclassical economics, based on rational assumptions, makes the building of economics as a science more complicated, rather than simpler, and more inaccurate rather than more correct. In Hayek's words: 'this is a consequence of the fundamental difficulty of any complete explanation of highly complex phenomena and not merely of an insufficient development of economic theory' (Hayek 1967, p. 259).

Conclusions

In one regard, Occam's razor is the more sophisticated and elegant version of what is usually considered common sense (Fenk, 2010). At an initial glance, Occam advocates simplicity and parsimony in order to reduce the risk of mistakes. The presumption that an increase in the number of hypotheses will increase the chances of formulating a wrong theory may be valid in physics, but it is misleading in the social sciences. When applied to the social sciences, economics in particular, Occam's razor logical blade gives us a model that lacks realism, whereas Occam's razor parsimony blade supplies a powerful heuristic: it does not reduce the complexity of an *explanandum*, but rather, it is able to cope with it in better terms, that of parsimony. The main fault of neoclassical economics is with its initial assumptions, which are oversimplified and unrealistic, both in terms of individual behaviour and in terms of social institutions. Neoclassical economists try to reduce the complexity of individual and social dynamics rather than to describe them in realistic terms. Rational choice theory, based on the general validity of the expected utility function, and general economic equilibrium, are representations of individuals and society somehow disconnected from the real world. In Simon's terms, the epistemology of neoclassical economics is inconsistent with our knowledge of actual human choice behaviour; in Hayek's terms, it is an abuse of reason.

There are many alternatives to neoclassical economics. Regardless of the differences among heterodox economic approaches, their main concern is to build up an economic discipline capable of defining economic agents and institutions in a way that makes adherence to reality more effective, and that is able to include complexity. Occam's razor

²⁴ I owe this observation to Cserne's comment on Simon in his referee report.

²⁵ About Simon's concept of bounded rationality, it is important to underline that it reduces the amount of information available to neoclassical *homo oeconomicus*, but does not radically deny the model of perfect knowledge. Nevertheless, Simon's bounded rationality broke the wall of neoclassical economics and many heterodox approaches to economics went through it.

parsimony blade allows complexity by adopting heuristic to describe human dynamics. This process opens up a more pluralistic view within economics.

Acknowledgements

With many thanks for Péter Cserne and Steve Fleetwood who provided comments and suggestions on an earlier version of this paper via the *Economic Thought* Open Peer Discussion forum.

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SUGGESTED CITATION:

Becchio, Giandomenica (2020) 'The Two Blades of Occam's Razor in Economics: Logical and Heuristic.' *Economic Thought*, 9.1, pp. 1-17. <http://www.worldeconomicsassociation.org/files/journals/economicthought/WEA-ET-9-1-Becchio.pdf>

Wine and bottles. Some remarks on “The Two Blades of Occam’s Razor in Economics: Logical and Heuristic” by Giandomenica Becchio

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The express ambition of this thought-provoking paper is to flesh out a distinction between two senses of “Occam’s razor” in order to argue for more “realism” in economics.

Becchio distinguishes the two senses as simplicity and parsimony, defining the latter, in Occam’s words as ‘in vain is that explained by many things which can be explained by fewer things’ (p.1). Becchio calls this a ‘powerful heuristic tool’ and hopes to provide philosophical backing for ‘[s]ome approaches of heterodox economics’, more precisely for ‘models grounded on realistic initial assumptions and able to embed complexity into the general explanation of economic behaviour’ (abstract).

As I will argue, while this philosophical ambition is to be saluted, the specific claims about the logical connection of Occam’s principles, parsimony, heuristics and the realism of assumptions are too vague to be persuasive. More analytical work is needed on identifying common criteria of theoretical success to compare economic models, theories and research programmes. The most charitable reading is that the two blades correspond to two such criteria that tend to point in different directions.

Arguments about the perceived excessive abstraction and lack of realism has a long history in economic theory, going back at least to the German *Methodenstreit* some 150 years ago. It has been a staple of methodological debates in economics ever since, with Friedman’s (1953) paper on the methodology of positive economics, the growth of experimental approaches and the behavioural turn in economics standing out as more recent milestones. (Notice how the milestone metaphor is suggestive of progress.) Compared to these, the ambition of Becchio’s paper is to show the superiority of ‘realistic’ models in a new way, i.e. in terms of parsimony.

A related but less elaborated theme of the paper concerns the specificity of ‘human’ or ‘social’ science amongst the sciences. This theme has also been on the methodological agenda of economic theory since at least J.S. Mill’s engagement with Comte’s positivism (Mill, 2015) but as it receives less attention, I will not discuss it further.

Against this background, Becchio’s attempt to exploit the analytical potential of ‘Occam’s razor’ to reframe the discussion is both promising and risky. If one seeks to contribute to progress in these debates, reframing them in unexpected terms may be illuminating and rewarding. It would indeed be an important theoretical feat to demonstrate that ‘Occam’s razor’ has the desired methodological implications for economics, justifying a move towards ‘parsimony’ *and thereby* ‘realism’. The risk is, of course, that the attempt may turn out to be yet another highly abstract critical argument against rational choice theory in the name of (whatever is understood as) ‘realism’ which rephrases old arguments in new terms without moving the substantive discussion forward. To put it metaphorically, the success of the paper hinges on whether it is able to fortify heterodox economics with the spirit of Occam, or whether it serves to economists some old (methodological) wine in new (Occamian) bottles.

Let’s start with the ‘bottles’. The paper’s conceptual frame and terminological choices are surprising at first, especially to those who recall Albert Hirschman’s paper, entitled

'Against Parsimony: Three Easy Ways of Complicating Some Categories of Economic Discourse'.¹ To be sure, nobody is bound by Hirschman's terminology. Defending heterodox economics as parsimonious, as Becchio does, suggests an innovative approach or at least a different rhetoric that may be just as persuasive in suggesting alternatives to neoclassical models in economics as the arch-heterodox Hirschman's arguments for realism *at the expense of parsimony*.

The rhetorical framing of distinguishing simplicity and parsimony seems to be inspired by a late paper by Herbert Simon (2001), an economics Nobel laureate and by general consensus a pioneer of what is now loosely called behavioural economics. Simon's paper uses the dichotomy in a wide-ranging and highly formal discussion of information theory, and illustrates the more abstract points by a retrospective overview of some substantive arguments in his earlier work on empirical decision theory. For Simon, the distinction of simplicity and parsimony refers to how through the identification and representation of redundancies, science seeks to identify patterns in a set of data and then represent them in the most parsimonious way. In particular, while the title of Simon's paper suggests an opposition of the two concepts, he in fact defines parsimony as a specific case of simplicity, itself being the reciprocal of the complexity of a data set.²

Becchio has, understandably, little to say on such matters of information theory; her focus is on substantive and methodological issues in economics. For her, the dichotomy of simplicity and parsimony serves as a suggestive rhetorical framing, with a highly respectable Occamian pedigree. The substantive idea driving the paper is the following: we should be concerned at least as much with one aim of economic theorising: 'realism' (somehow achieved through the use of one 'blade' of Occam's razor, parsimony) as with the other: 'simplicity' (the other 'blade' of Occam's razor, as well as the methodological common denominator and driving force of 'neoclassical' economics). So far, we have three concepts in two juxtapositions then. The success of Becchio's proposal depends on how the two criteria or aims of parsimony and realism relate to each other.

The conceptual landscape is complicated further when the author suggests mapping the distinction of simplicity versus parsimony onto the dichotomy of a (pure) logical (tool) versus (a) heuristic. The meaning of this opposition between logic and heuristic is somewhat opaque but it relates to a key concern of the author: a certain 'trade-off between simplicity and realism' which is specific to 'the human sciences'.³ I will briefly return to this question of 'bottles', i.e. the conceptual and terminological choices of the paper at the end of this comment. Let's now turn to the 'wine', i.e. the substantive points in the paper concerning the simplicity – realism trade-off and the argument for realism in economics.

To start with, the reader is referred to some of the earlier explications of the idea of simplicity in the history of economics. The debate surrounding Milton Friedman's 1953 paper

¹ Hirschman, 1984. In Cserne 2019, I identify and analyse three arguments for parsimony in economics, using the term roughly in Hirschman's sense.

² 'The primordial acts of science are to observe phenomena, to seek patterns (redundancy) in them, and to redescribe them in terms of the discovered patterns, thereby removing redundancy. The simplicity that is sought and found beautiful is the simplicity of parsimony, which rests, in turn, on the exploitation of redundancy. We do not seek the absolutely simplest law but the law that is simplest in relation to the range of phenomena it explains, that is most parsimonious' (Simon, 1997 p. 6). I am quoting from what appears to be the working paper version of Simon's 2001 chapter as I had difficulties accessing the 2001 version under the current circumstances. In the final version of her paper, Becchio (p. 2) acknowledges that parsimony is 'a proper subset of simplicity'.

³ 'In using Occam's razor as a pure logical tool, one that gives simplicity to a model, neoclassical economics commits a fault: it neglects the fact that in the human sciences a trade-off between simplicity and realism exists, and this trade-off cannot be confused with the degree of abstraction that characterizes the object of any natural science, like physics, because human behaviour cannot be confused with the behaviour of, say, atoms' Becchio p. 3.

on 'The methodology of positive economics' is crucial in this respect. Yet, unfortunately, we are left without the author's definite take on Friedman's methodology. While she summarises some of the subsequent discussion (of special interest here is Ernst Nagel's critique of Friedman's methodology, based on the claim that Friedman failed to distinguish among three kinds of 'unrealism') and introduces a distinction between abstraction and idealisation (Becchio pp. 7-8), the reader is left perplexed as to what the lesson of the debate is. It is also perplexing what is implied when the author puts Friedman and Samuelson in the same category of 'positivists', using the term with a clear disapproval. Could this mean that she considers the entire debate around Friedman's methodological stance irrelevant or misguided? If so, why bother discussing it? If valid and relevant points have been raised in the debate, what are these?

As for simplicity, Becchio is right in referring to the difficulties in defining, let alone measuring it (Becchio p. 4 n 8). In a later turn of the argument, she even denies that under a reasonable definition of simplicity, neoclassical models are simple: their 'simplicity becomes apparent and is misleading' (Becchio p. 6). Clearly, there is a case to argue that one kind of simplicity may lead to the lack of it in another sense, for instance when accounting for certain empirical phenomena requires *ad hoc* assumptions and cumbersome adjustments to an initially simple model. In fact, Becchio distinguishes four versions of simplicity. Clearly, more analytical effort is needed here in identifying how these versions, including parsimony ('a proper subset of simplicity') are related. As simplicity is not the only possible virtue of models, theories and research programmes, more needs to be said about how simplicity competes with or complements other criteria of theoretical success, before a meaningful assessment of various types of economic models can be made.

In a subsequent paragraph of section 2, Becchio moves on to discuss 'the reduction of complexity' (Becchio p. 8) achieved in rational choice theory, in particular through the *homo oeconomicus* model. Again, she seems to work under the assumption that by summarising certain claims raised in earlier debates, for instance, by quoting Rosenberg who called rational choice theory 'formalized folk psychology'⁴, she has performed a satisfactory critical analysis.

In sum, section 2 offers, a brief and sketchy overview of some debates on 'simplicity' and 'realism' in 'mainstream' or neoclassical economics. Based on the claim that 'neoclassical economics rests on hypotheses and assumptions that are not just simple (in terms of Occam's razor) but oversimplified and inconsistent with reality' (p. 6), her conclusion seems to be that 'neoclassical economics [...] does not explain the *complexity* of human actions in a *realistic way*' (p. 9, emphasis in the original). How one should interpret this claim depends crucially on what is meant by 'realistic'. For the argument from realism to get off the ground as philosophy of economics, an explicit conception of realism in theory-building is required. Although the references (to Nagel, Mäki and others) suggest that the author is aware of possible starting points, unfortunately this key concept is not explicated in a systematic way in the paper. To provide a meaningful and reasonable criticism of neoclassical economics in terms of the simplicity-realism trade-off, requires further analytical effort in explicating, operationalising and measuring both (dimensions of) simplicity and 'consistency with reality' as criteria of theoretical success.

⁴ The subsequent quote from Buchanan (on p. 9) is not easy to interpret, nor is it clear what role it plays in Becchio's argument. Is it an illustration of the criticised position or an endorsement of the author's criticism? On the face of it, it does not seem to support either. It is difficult to discern what Buchanan means by the potentially confused spatial metaphor of 'within the boundaries between...'. Does he refer to a theoretical space in between theories, i.e. a third one different from both? Or does he mean the intersection of the theories, thus recognising some common features of both?

In section 3, the author introduces what is supposed to be another interpretation ('blade') of Occam's razor which, in the hands of 'heterodox' economists, leads to results that the author finds superior in terms of the simplicity-realism trade-off. As noted above, there is some terminological confusion arises when the second interpretation of Occam's razor as parsimony is characterised as (a) 'heuristic'. This terminology is, however used in an ambivalent way, generating confusion. From the start, it is unclear whose use of heuristics is referred to. The term can refer to either (1) the methodological rule of thumb used by researchers while building theories or (2) to specific features of human behaviour under a certain theoretical description, namely when (economic) agents are modelled as using rules of thumb while navigating their complex environment. This ambivalence is left unresolved and becomes especially pertinent in the discussion of Gigerenzer's theory. One way to resolve it would be to naturalise the former use, i.e. (1') re-describe theory-building behaviouristically as a human activity, as a special case of human decision-making. Such a naturalised theory of science is perhaps broadly in line with Gigerenzer's or Herbert Simon's approach to (economic) theorising but it is in tension with the rest of the paper's stance as normative philosophy of science. In fact, it seems that the author refers to heuristics in the original sense (1) and remains within the domain of analytical and normative philosophy of science, when contrasting one type of models or method ('neoclassical', 'static', 'mathematical-deductive') with another, preferred, type of 'alternative models, such as rhetoric, persuasion, metaphors, and heuristics' (Becchio p. 9).

In the second half of the paper, the author's aim is both to explicate parsimony as one (or the?) adequate criterion of theoretical success, and to demonstrate how this criterion favours heterodox economic models over neoclassical ones. This is a significant task, and in a few pages, there is hardly enough room for more than assertions and hints. Thus, the author asserts that by using Occam's razor as a 'heuristic tool', one could 'build up a coherent and realistic theory of human behaviour and economic dynamics in social terms' (Becchio, p. 9) It is mainly through hints at Herbert Simon's ideas about satisficing behaviour and Gigerenzer's evolutionary theory of heuristics that this claim is to be made plausible. Thus, the author suggests (p. 11):

'If we intend satisficing as a humanly rational strategy, it appears simpler and more frugal than maximizing because in this scenario, individuals are following the rule of thumb in a dynamic context; while in the neoclassical scenario individuals are optimizers in a static and non-realistic context of perfect knowledge and complete information.'

Satisficing as an empirical generalisation about human behaviour or Gigerenzer's 'fast and frugal heuristics' approach are surely possible starting points of a fruitful and powerful research programme. Yet it is worth keeping in mind that their specific models of human behaviour are subject to the simplicity/realism trade-off in the same manner as are models of maximisation or optimisation. At the very least, a meaningful comparison of rational choice, satisficing, 'heuristics and biases' or 'dual processing' models requires the use of the same criteria of success. Thus, a fruitful question here is: under what criteria and in what contexts are these 'alternative models' superior to the former ones.⁵

Let me return to the question of bottles, i.e. the terminological and conceptual choices of the paper and the possible theoretical motivations for these choices. Thus far, I have assumed that the main concern of the paper is a certain trade-off between simplicity and

⁵ At an earlier point in the argument (p. 6 n. 15), the author cites blanket criticisms of neoclassical model-building as a 'powerful rhetorical discourse' and 'pseudo-science'.

realism. As far as this is correct, there are various possible framings of the problem which can be compared in terms of transparency, rhetorical power and other criteria. As far as the explicit arguments in Becchio's paper go, some bottles are better than others.

It is doubtful whether the paper's substantive argument for realism is made any stronger by linking it to Simon's 2001 paper, even when he explicitly refers to Occam. Simon the information theorist uses an analytical distinction between simplicity and parsimony and does not talk about 'realism'. Nor does he imply the choice of parsimony over simplicity as a superior criterion of inter-theoretical comparison. If Becchio wants to characterise simplicity and realism as a trade-off, how is it coherent with Simon's specification of parsimony as a version of simplicity? It seems that the invocation of parsimony or Occam's razor is neither necessary nor sufficient to support the comparison of various economic models in terms of realism and simplicity.

To recall, Hirschman, the arch-heterodox economist followed another, rather conventional methodological route, *viz.* to argue in favour of realism and against parsimony. To put it differently, Hirschman did not see realism and parsimony as necessarily pointing in the same direction. This suggests that there is a possible trade-off between the two. This conceptual framework allows for a rather simple, perhaps simplified, but transparent explanation of how standard and heterodox models are conventionally compared in economics: a gain in realism at the expense of simplicity.

As a variant on this conventional conceptual strategy, consider Richard Thaler (1992, p. 198), another Nobel laureate and founder of behavioural economics, who once noted that devising accurately descriptive models of human behaviour is difficult because many theorists have a 'strong allergic reaction to data'. Moreover, economic models based on the assumption of rationality are 'elegant with precise predictions', while behavioural research tends to be 'messy, with much vaguer predictions'. He then asked a rhetorical question: 'would you rather be elegant and precisely wrong, or messy and vaguely right?' (Thaler, 1992, p. 198). This suggests that there are two important dimensions of inter-theoretical comparison; furthermore, one (truth, something similar to realism) is more important than the other (elegance, perhaps something akin to simplicity).

Undoubtedly, philosophers of economics feel a strong temptation to go beyond these conventional and unsophisticated metatheoretical frameworks. If this motivates them to innovative rhetorical framings and conceptual innovations, such as the invocation of Occam, the dissociation of simplicity and parsimony and the association of parsimony and realism, the result is always refreshing and potentially fruitful.

Yet if one starts to speculate about the ultimate underlying ambition of this paper, there is a certain ambiguity. Are the claims meant as conceptual or substantive ones? It may be possible to carve out an argument that the two criteria, realism and parsimony necessarily point in the same direction: this would require some conceptual heavy lifting. It is also possible that in a comparison of two theories or two models, the first is both more realistic and more parsimonious than the other. To make the substantive (empirical) argument that this is (or is not) the case for any two specific pairs (or n-tuples) of theories or models, one needs, apart from a minimal conceptual clarity, to operationalise and measure theories and models in these two dimensions. If Becchio wants us to take either of these less conventional routes further, she owes us a more elaborate argument.

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SUGGESTED CITATION:

Cserne, Péter (2020) 'Wine and bottles. Some remarks on "The Two Blades of Occam's Razor in Economics: Logical and Heuristic" by Giandomenica Becchio.' *Economic Thought*, 9.1, pp. 18-23.
<http://www.worldeconomicsassociation.org/files/journals/economicthought/WEA-ET-9-1-Cserne.pdf>

The Empirical Success of Keynesianism¹

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Abstract

The main thesis of this paper is that the empirical success of Keynesianism shows it to be scientific. Keynesianism here refers not to a specific theory, but to a paradigm. It is argued that Kuhn's notion of paradigm can be applied to economics, but, in contrast to the natural sciences, in economics there are always competing paradigms. The principal ones in contemporary economics are the Neoclassical, Keynesian and Marxist. To investigate whether the Keynesian paradigm is scientific we need a criterion for the scientificity of a paradigm. The paper first considers one approach to this problem due to Kant, but this is rejected as incorrect and called 'the Kantian fallacy'. Another approach is then put forward: 'the empirical confirmation principle', and reasons are given for accepting this as correct. Using this principle, it is then argued that that Keynesianism is indeed scientific.

Keywords: confirmation, Kantian fallacy, Keynes, Kuhn, paradigm, Neoclassical economics

1. Paradigms in Economics

In this section, I want to argue that Kuhn's concept of paradigm can usefully be applied to economics, although paradigms in economics differ in one crucial respect from those in the natural sciences. I will therefore begin by saying something about the notion of paradigm.

Kuhn, in his 1962 *The Structure of Scientific Revolutions*, presents a view of the natural sciences which has become very well-known and quite widely accepted. According to Kuhn, mature natural sciences develop for the most part in a manner which he describes as 'normal science'. During a period of normal science, all the scientists working in the field accept the same framework of assumptions which Kuhn calls a 'paradigm'. However, these periods of normal science are, from time to time, interrupted by scientific revolutions in which the dominant paradigm of the field is overthrown and replaced by a new paradigm. This model is proposed by Kuhn for the natural sciences, and indeed Kuhn, who was originally trained as a physicist, worked almost exclusively on the history and philosophy of the natural sciences. Still, in the Preface of his 1962 book, he makes some remarks about the social sciences, which, despite their brevity, contain, in my view, a very important insight.

Kuhn writes as follows:

¹ This paper is the result of the many meetings of the Post-Keynesian school, which I attended over the years, and also of my discussions with leading members of that school, particularly Bradley Bateman, Victoria Chick, John Davis, Tony Lawson, Jochen Runde and Robert Skidelsky. That is not to say of course that these researchers will necessarily agree with the contents of the paper! I am also, as usual, grateful to my wife: Grazia letto Gillies for many helpful comments. The journal *Economic Thought* unusually operates an open review process with a discussion forum. I thought this worked well. The reviewers of my paper: Rafael Galvão de Almeida, Arne Heise and Dave Taylor were not inhibited by the openness from expressing quite strong criticisms of the first version of the paper, as did the editor: Michel Zouboulakis. These criticisms led me to make several alterations, including a change of title. I have acknowledged some of the suggestions of these reviewers and of the editor in footnotes.

'The final stage in the development of this monograph began with an invitation to spend the year 1958-59 at the Center for Advanced Studies in the Behavioral Sciences... spending the year in a community composed predominantly of social scientists confronted me with unanticipated problems about the differences between such communities and those of the natural scientists among whom I had been trained. Particularly, I was struck by the number and extent of the overt disagreements between social scientists about the nature of the legitimate scientific problems and methods... Attempting to discover the source of that difference led me to recognise the role in scientific research of what I have since called "paradigms"' (Kuhn, 1962, pp. ix-x).

So Kuhn developed the theory that natural scientists normally agree on the same paradigm by observing that this was not the case for social scientists. At first Kuhn seems to have thought that the term 'paradigm' should be restricted to fields where there was a unique paradigm, so that the social sciences could be characterised as having a number of competing schools of thought but no shared paradigm. Later, however, he reached the conclusion that each of these competing schools had its own paradigm. As he says (1962, p. xi): 'Each of the schools ... is guided by something much like a paradigm'.

I will adopt Kuhn's second position here, so that the difference between the natural sciences and the social sciences can be put as follows. In the natural sciences, outside revolutionary periods, all the scientists accept the same paradigm. In the social sciences, however, social scientists are divided into competing schools. Each school has its own paradigm, but these paradigms are often very different from each other. The contrast is between a single paradigm and a multi-paradigm situation.

As far as the natural sciences are concerned, we can illustrate this with the example of theoretical physics. In this field, all scientists accept a paradigm whose core consists of relativity theory and quantum mechanics. It is not that contemporary theoretical physicists are excessively dogmatic. Most of them probably think that, at some time in the future, there will be another revolution in theoretical physics which will replace relativity and quantum mechanics by some new, and perhaps even stranger, theories. However, they would argue, relativity and quantum mechanics work very well, and so it is sensible to accept them for the time being. If we turn now to economics we find a very different situation.

Economics is a social science, and Kuhn's analysis proves to be quite correct. The economics community is divided into different schools. Moreover the members of one school are often extremely critical of the views of members of another school. The school of economics, which has the most adherents at present, is Neoclassical economics. The majority of economists are Neoclassical, and this approach can justly be referred to as the mainstream. However there are several other schools of economics. We can mention the Austrian, Institutional, Keynesian, and Marxist. In addition there are Sraffian, or neo-Ricardian economists, evolutionary economists and economists who use complexity theory. Although this variety of different schools of economics should be borne in mind, it will be convenient in this paper to limit the discussion, for simplicity, to what I take to be the principal schools. These are Neoclassical economics, Keynesianism and Marxist economics.

Do these three principal schools of economics each have a paradigm in the sense of Kuhn? To answer this question, let us look at the passage in which Kuhn introduces the concept of paradigm. It is the following:

'Aristotle's *Physica*, Ptolemy's *Almagest*, Newton's *Principia* and *Opticks*, Franklin's *Electricity*, Lavoisier's *Chemistry*, and Lyell's *Geology* – these and many other works served for a time implicitly to define the legitimate problems and methods of a research field for succeeding generations of practitioners. They were able to do so because they shared two essential characteristics. Their achievement was sufficiently unprecedented to attract an enduring group of adherents away from competing modes of scientific activity. Simultaneously, it was sufficiently open-ended to leave all sorts of problems for the redefined group of practitioners to resolve.

Achievements that share these two characteristics I shall henceforth refer to as "paradigms"...' (Kuhn, 1962, p. 10).

Kuhn here mentions key texts in the natural sciences, but, if we make a similar list of key texts in economics such as Marx *Capital*, Keynes *The General Theory* and the books by the founding fathers of neo-classical economics, then we find that much of what Kuhn says applies also to these texts. These 'works served for a time implicitly to define the legitimate problems and methods of a research field for succeeding generations of practitioners'. Taking Keynes *The General Theory* as an example, it is true to say that its 'achievement was sufficiently unprecedented to attract an enduring group of adherents away from competing modes of ... [economic] ... activity' and that 'it was sufficiently open-ended to leave all sorts of problems for the redefined group of practitioners to resolve'. This, I think, justifies the use of Kuhn's term 'paradigm' in economics, but a key difference between economics and the natural sciences must not be forgotten. Keynes *The General Theory* did not establish a consensus in the field of economics. Many practitioners remained loyal to older paradigms such as the Marxist and the Neoclassical.

There is a second important point of difference between economics and the natural sciences. If we consider paradigms in economics, they appear to be associated with political ideologies. Taking the Marxist, Keynesian and Neoclassical paradigms, it seems obvious that they are arranged on a political spectrum running from the left to the right.

Let us begin with Marxist economics. Perhaps the central claim of the Marxist paradigm is that the profits made by capitalists arise out of the exploitation of workers.² This is expounded in *Capital*, Volume 1, Chapter IX, Section 1, which is entitled: 'The degree of exploitation of labour power'. Marx does not here use the term 'profit' but 'surplus-value'. According to his account, surplus value is extracted from the workers and then divided up into profits, interest and rent. So profits are only a part of surplus-value. Regarding the rate of surplus-value, Marx says:

'The rate of surplus-value is therefore an exact expression for the degree of exploitation of labour-power by capital, or of the labourer by the capitalist' (1867, p. 218).

The political message of this point of view is clear enough. No one wants to be exploited. So, if the Marxist claim is correct, then workers should seek to abolish capitalism and replace it by socialism. This is just what the Marxists advocate. Here the connection between economic theory and political ideology is quite transparent and is openly acknowledged, indeed emphasised, by Marxists.

² Rafael Galvão de Almeida suggested that I elaborate this claim with a quotation from Marx himself which I do in the next few lines.

Let us next turn to Neoclassical economics. The core of the Neoclassical paradigm is equilibrium theory. In a Neoclassical equilibrium model, we have firms which organise their production in order to maximise their profits, given the existing technology; and households which organise their consumption in order to maximise their utility, given their income. It is then shown that, if there is a market with free competition, this behaviour leads to an equilibrium which is Pareto-optimal. Pareto-optimality means that no redistribution of goods or productive resources can improve the position of one individual without making at least one other individual worse off. The political implications of this are again clear. A market with free competition delivers the best (the Pareto-optimal) results for everyone. Hence politicians, in the interest of society as a whole, should to use the phrase of Portes and Baldusson (2007, p. 63) introduce 'market liberalisation ... and privatisation'. Indeed this is just what politicians the world over have been doing in recent decades, justifying their actions by an appeal to Neoclassical economics. Keen has the following interesting passage about the consequences of Neoclassical economics:

'If you believe that a free market system will naturally tend towards equilibrium – and also that equilibrium embodies the highest possible welfare for the highest number – then *ipso facto*, any system other than a complete free market will produce disequilibrium and reduce welfare. You will therefore oppose minimum wage legislation and social security payments – because they will lead to disequilibrium in the labour market. You will oppose price controls – because they will cause disequilibrium in product markets. You will argue for private provision of services – such as education, health, welfare, perhaps even police – because governments, untrammelled by the discipline of supply and demand, will either under or oversupply the market (and charge too much or too little for the service)' (Keen, 2001, p. 163).³

These consequences certainly make it look as if Neoclassical economics involves a right-wing political ideology.

Keynesians hold a position intermediate between Marxist and Neoclassical economists. Keynesians would not agree that markets with free competition always deliver the best results for society. Keynes himself definitely reached this conclusion during the 1930s when the free market seemed to have delivered the Great Depression with massive unemployment and under-utilisation of capacity. In his economic theory Keynes showed how markets could lead to this sub-optimal situation, and also how government intervention could correct the flaws of the market. However, Keynes did not go as far as the Marxists in advocating the complete abolition of capitalism and the market. He argued for a limited degree of government intervention, which would correct the defects of the market while leaving a great deal of economic activity to the market. Naturally this kind of compromise position can occur in different forms depending on how much government intervention is seen as necessary. The right wing of the Keynesians have developed a version of Keynes' original theory which fits the Neoclassical framework and is known as the Neoclassical synthesis. Its adherents advocate rather little government intervention. The more left wing Keynesians support more radical government interventions in the economy. Indeed the left wing of the Post-Keynesians overlaps to some extent with the Marxist school, even though Keynes himself was strongly opposed to Marxism and in his *Essays in Persuasion* expresses astonishment regarding Marxian socialism as to: 'how a doctrine so illogical and so dull can

³ In the second edition of the book, Keen (2011), this passage is on page 173.

have exercised so powerful and enduring an influence over the minds of men, and, through them, the events of history' (1931, p. 285).

These are my arguments for the conclusion that every paradigm in economics is closely associated with a corresponding political ideology. However, this view is not held by everyone. There is an opposite opinion that it is possible to construct a positive economics, which is entirely factual and does not involve any values or ideologies. A leading exponent of this idea was Lionel Robbins in his 1932 book. I will now examine how Robbins defends his position.⁴

Robbins does not speak of ideologies but use other terms such as 'valuations'. He writes:

'In recent years, certain economists ... have urged that the boundaries of the subject should be extended to include normative studies. Mr Hawtrey and Mr J.A.Hobson, for instance, have argued that Economics should ... take account of valuations and ethical standards... "Economics", says Mr Hawtrey, "cannot be dissociated from Ethics".

Unfortunately it does not seem logically possible to associate the two studies in any form but mere juxtaposition. Economics deals with ascertainable facts; ethics with valuations and obligations. The two fields of enquiry are not on the same plane of discourse. Between the generalisations of positive and normative studies there is a logical gulf fixed which no ingenuity can disguise and no juxtaposition in space or time bridge over.' (Robbins, 1932, p. 132).

Now, within economics, there may indeed be some propositions which could be described as 'ascertainable facts'. For example, if sufficient statistics are available, the average wage of a manual worker in a specific country and year may be an ascertainable fact. However, as soon as we move to the more theoretical propositions of economics, the picture changes. Such propositions involve concepts which do appear to be value-laden and so are not simply ascertainable facts. This can be seen by considering an example which Robbins deals with in detail, namely: minimum wage regulation.

It is surprising that Robbins should choose this example, since it does not seem *prima facie* to support his position very well. Debates about minimum wage have occurred regularly in the past few decades and they always provoke a furious and rather predictable debate between the right and the left. Right wing politicians characteristically argue that minimum wage regulation would only price workers out of jobs and so would really be worse for them. To this, left wing politicians characteristically reply that employers could easily afford to pay higher wages and they only refuse to do so in order greedily to increase their already large profits. Could this question, seemingly so fraught by political ideology, really be settled simply by an appeal to 'ascertainable facts'? Robbins thought that it could, for he writes:

'we may examine the case of minimum wage regulation. It is a well-known generalisation of Theoretical Economics that a wage which is held above the equilibrium level necessarily involves unemployment and a diminution of the value of capital. This is one of the most elementary deductions from the

⁴ Rafael Galvão de Almeida in his comment on the first draft of my paper objected that I had not taken account of the views of those who think that economics can be value free, and suggested that I should consider the arguments of Robbins who was one of the leading proponents of this position. The section on Robbins which follows, was added in response to this criticism.

theory of economic equilibrium. The history of this country since the War is one long vindication of its accuracy' (Robbins, 1932, p. 130).

When Robbins speaks of 'the history of this country since the War', he is referring to the UK in the years 1919-1931, but how during any specific year does one tell whether a particular wage is above the equilibrium level? These years were noted for the economy undergoing extreme fluctuations. A boom up to 1929 was followed by a slump thereafter. There was never any prolonged state of equilibrium. Thus to work out the equilibrium level of wages is not an easy matter. It involves hypothetical considerations, and so it remains unclear whether the result is really an 'ascertainable fact'. Moreover if we look more closely at the concepts involved in defining economic equilibrium, such as 'utility' and 'Pareto-optimal', they do appear to involve valuations and ideology.

Robbins was working within a version of Neoclassical economics strongly influenced by the Austrian school. Yet an example from the Marxist paradigm has many similar features. Let us compare Robbins' example: 'a wage which is held above the equilibrium level necessarily involves unemployment' with the Marxist example given earlier: 'profits arise from the exploitation of the workers'. A defender of Marxism would no doubt say: 'the data on 19th century capitalism given by Marx in *Capital* is one long vindication of the accuracy of this proposition'. However, as we have seen the concept of exploitation is defined in terms of the labour theory of value and the value of any commodity is not something that can be determined by observation in any easy or straightforward fashion.

Robbins regarded the theoretical proposition which he gives as an example as an ascertainable fact forming part of positive economics, but what would he have said about the Marxist proposition just mentioned which seems to have some features in common with Robbins? Of course, we can never know what Robbins would have said on this question, but it can be pointed out that none of the options available to him are very satisfactory.

He could have said that 'profits arise from the exploitation of the workers' is obviously an ideological value-judgement, whereas 'a wage which is held above the equilibrium level necessarily involves unemployment' is a purely factual statement which forms part of positive economics. But the obvious reply would be that he simply shows himself to be a man who is aware of the biases of others, but unconscious of his own. If a statement has left wing implications, he recognises it as ideological, but if it has right wing implications he regards it as just a matter of fact, not involving any ideology. The other option open to Robbins would be to say that 'profits arise from the exploitation of the workers' is a purely factual statement but a false one. However, this is hardly satisfactory. The Marxists themselves regard this statement as ideological, and it certainly looks highly ideological. Could it really be purely factual?

My conclusion is that the arguments of Robbins are not very convincing. However, the comparison I have drawn between statements within Robbins' own paradigm, and statements within the Marxist paradigm, is useful for the next topic I want to consider. Both Robbins and the Marxists regard the type of economics they do as scientific. Robbins speaks of 'Economic Science' both in the title of his book, and in the title of Chapter VI. This 'Economic Science' is of course economics done within the Neoclassical/Austrian paradigm. Famously in his speech at the graveside of Karl Marx in 1883 Engels claimed that while Darwin had produced a science of the biological world, Marx had produced a science of the human world.

Now we know that there are scientific paradigms in the natural sciences. The Newtonian paradigm which was the basis of normal science for nearly two hundred years is an obvious example; as is the Darwinian paradigm of evolution by natural selection which is

still accepted today. But what about the paradigms of economics? Are any of them scientific? Or are they all purely ideological? If they are ideological to some degree, does this prevent them from being scientific? These questions are difficult to answer. It is straightforward to say that a paradigm is scientific if a number of theories developed within it are scientific, but when is a theory scientific? In fact there are a number of different suggestions about what makes a theory scientific, and these different suggestions lead to different results regarding economics. In the next two sections, I will expound two of these suggestions. Section 2 deals with one made by Kant. As we shall see, this suggestion, if accepted, would lead to the conclusion that Neoclassical economics is scientific, while Keynes' *General Theory* is not scientific. However, I will argue against Kant's suggestion, describing it as 'The Kantian Fallacy'. Then in section 3, I will consider a more empiricist suggestion that a theory is scientific if it is empirically confirmed. Using the criterion of section 3, I will, in section 4, argue for the main thesis of this paper, namely that the empirical successes of Keynesianism show that it is scientific.

2. The Kantian Fallacy

In his book: *Metaphysical Foundations of Natural Science*, published in 1786, Kant made the following claim:

'I maintain... that in every special doctrine of nature only so much science proper can be found as there is mathematics in it' (Kant, 1786, p. 6).

It is worth noting that Kant's claim here is about 'special doctrines of nature', i.e. the natural sciences. Let us, however extend the claim to the social sciences and see what results it would give regarding economics.

We have identified the three major paradigms in economics as the Neoclassical, the Keynesian and the Marxist. Of these three, it is clear that Kant's claim extended to the social sciences would favour the Neoclassical paradigm, because the theories of Neoclassical economists contain much more mathematics than those of the Marxists or of Keynes himself and the Post-Keynesians. I will, however, argue that Kant's claim is false, both as applied to the natural sciences and also as extended to theories outside the natural sciences.

Let me begin by considering the natural sciences. Here, as is so often the case with Kant's views, Kant's claim was quite plausible when he made it in 1786, but developments in science and mathematics in the 19th century went strongly against it. In 1786, the leading theory in the natural sciences was Newtonian mechanics. In fact Kant's book is really focussed on providing metaphysical foundations for Newton's theory, which he seems to regard as virtually the whole of natural science. Now Newton's theory was highly mathematical. So it is not so surprising that Kant concluded that a theory of nature would have to contain a lot of mathematics in order to be genuine science.

Another candidate for being a natural science in 1786 was chemistry, but Kant rules chemistry out, saying:

'chemistry can become nothing more than a systematic art or experimental doctrine, but never science proper' (Kant, 1786, p. 7).

Once again this view was not so implausible in 1786 when chemistry was still in a rather primitive state. However, things were soon to change. In 1789, Lavoisier published his *Traité élémentaire de Chimie*, in which he put forward his new definition of chemical element, and

his new oxygen theory of combustion. This book, which was translated into English the next year, became the basis of a new paradigm which was generally accepted by chemists. Research in this paradigm led to a tremendous development of chemistry so that by the middle of the 19th century, no one would have doubted that chemistry was a very successful science. Yet this new chemistry did not contain much mathematics. Chemistry involved a lot of weighing and measuring and examining of proportions. This required basic arithmetic, but that was really all the mathematics to be found in chemistry. Chemistry was a science proper, but involved very little mathematics, thus showing that Kant's 1786 claim was false.

Let us now generalise Kant's claim about the theories of natural science to theories in general, including those of the social sciences. This generalised Kantian claim takes something like the following form.

A theory is scientific to the extent to which it contains mathematics. (*)

(*) is of course still refuted by the example of 19th century chemistry, but it is also refuted by the development of mathematics in the 19th century.

Before the 19th century, nearly all of mathematics was such that it could be, and was, applied to the physical world. However, the 19th century saw the development of pure mathematical theories, which had no application either in physics or elsewhere. An example of this is Cantor's theory of transfinite cardinal numbers greater than aleph 0 (\aleph_0). This is a highly mathematical theory, but it has never been applied in physics or in any other science. So it cannot be considered to be scientific. This again contradicts (*). My conclusion is that (*) is false, and I will refer to it from now on as 'The Kantian Fallacy'.

But if (*) is fallacious, how then do we judge whether, and to what extent, a theory is scientific? In the next section I will argue for another approach to this question, which is empiricist rather than Kantian.

3. Empirical Confirmation shows a Theory to be Scientific

An empiricist approach to the question of whether a theory is scientific considers the relation of the theory to empirical data – that is to propositions that can be established as true by observation and/or experiment. However this general idea can be worked out in various ways. Let us start by considering Popper's notion of falsifiability or refutability.⁵

Popper's concept is usually illustrated by the example of the generalisation: 'all swans are white'. This was confirmed by all the observations made by Europeans in Europe, and so was generally held to be correct by them. However when the first Europeans went to Australia, they observed black swans and hence refuted or falsified the generalisation. Popper developed from this simple example the theory that science consists of conjectures and refutations. This in turn suggests that we could regard a theory as scientific if it is falsifiable by empirical data.⁶ However, this quite plausible suggestion encounters a problem which has become known to philosophers of science as *the Duhem-Quine thesis*.

Duhem formulates his version of this thesis as follows:

⁵ In response to comments by Arne Heise and Michel Zouboulakis, I decided to include a discussion of Popper's falsifiability and the Duhem-Quine thesis, and this is done in the following five paragraphs. In order not to disturb the balance of the paper, I have given only a sketch of these matters. For the interested reader, there is a much more detailed treatment of these issues in Gillies, 1993, Ch.5, pp. 98-116, and Ch.10, pp. 205-230.

⁶ Popper's own formulation of his demarcation criterion is more complicated than this. For a full discussion with quotations, see the reference given in the previous footnote.

An Experiment in Physics Can Never Condemn an Isolated Hypothesis but only a Whole Theoretical Group (1904-5, p. 183, italics and capitals in original).

We can explain what Duhem means here by considering the example of Newton's First Law or the Law of Inertia (T_1 say). This states that every body continues in its state of rest, or uniform motion in a straight line, unless it is compelled to change that state by forces impressed upon it. Now no one doubts that T_1 is a scientific law. Yet it is not so easy to falsify by observation and/or experiment as was the case with 'all swans are white'.

Suppose, for example, we want to try to falsify T_1 by observations of the planets. We cannot derive any statements about the movements of planets, which can be compared with observation, from T_1 alone. We have to add to T_1 , Newton's other two Laws of Motion (T_2 and T_3 say), his Law of Gravity (T_4 say), and also some Auxiliary Assumptions (A say). A consists of assumptions like the following: no other forces but gravitational ones act on the planets, the mass of the Sun is very much greater than that of any of the planets, and so on. Once we have created this 'whole theoretical group', we can indeed deduce from it a statement O which can be compared to observations of the Solar System. Suppose now O is shown to be incorrect, we cannot deduce that T_1 is false, but only that one or more members of the theoretical group $\{T_1, T_2, T_3, T_4, A\}$ are false. The observational result does not tell us which members of the group are false, and so T_1 is not falsifiable, despite being clearly scientific.

Duhem's formulation of his thesis given above could be criticised. There are, in physics, some hypotheses which are falsifiable. For example, Snell's law of refraction applied to glass. Similarly other natural sciences contain both falsifiable hypotheses and hypotheses which are not falsifiable. Broadly speaking it is the higher level hypotheses, containing more abstract theoretical terms, which are not falsifiable because of the Duhem-Quine thesis, but which should still be regarded as scientific. So falsifiability is not an adequate criterion for demarcating scientific theories from non-scientific ones.

In the reference given in footnote 5, I argue in detail that falsifiability should be replaced by confirmability as an appropriate criterion for demarcating science from non-science (see particularly Gillies, 1993, pp. 214-220). I will now apply this approach to economics.

My suggestion is to replace (*) (the Kantian fallacy) by the following:

A theory is scientific to the extent that it is empirically confirmed. (**)

I will call (**) 'The Empirical Confirmation Principle'.

A theory T is empirically confirmed by evidence e , if e can be regarded as established by observation and experiment. The degree of empirical confirmation of T by e is written in symbols: $C(T, e)$, and there have been attempts to develop a formal theory of $C(T, e)$ which shows its relation to probability $[P(T | e)]$. I discuss formal confirmation theory in my (1998) which also considers an area in which such a formal theory is useful, namely artificial intelligence. However, if our aim is to judge whether an economic theory is empirically confirmed, such formalisations and technicalities are more likely to obfuscate than to clarify the situation. What is needed is an informal, qualitative, method for assessing empirical confirmation. In fact such an informal qualitative approach is that taken by scientists themselves when they consider whether one theory in their field is better confirmed by evidence than another. I will now sketch an informal qualitative method for assessing empirical confirmation, and illustrate it by considering Kant's example of Newtonian theory.

The basic idea of this qualitative approach is to regard a theory T as empirically confirmed by successful explanations and/or successful predictions. In the second case, a prediction is made on the basis of T of an event which will occur in the future. If the predicted event is shown by observation and/or experiment actually to occur, the prediction is successful and T is confirmed empirically. In the first case, we suppose that a number of facts f_1, f_2, \dots, f_n have been established in the sense that they have been well confirmed by observation and/or experiment, and so can be assumed to be true (at least when interpreted as approximations) while the attempt at theoretical explanation is being made. In this case, if T is sufficiently simple and successfully explains these facts, it is confirmed empirically.

Let us now see how this applies to the example of Newton's theory as set out in his *Principia* of 1687. In this work Newton successfully explained a whole range of facts. He explained why Kepler's Laws and Galileo's law held approximately, but he also explained some observed deviations from these laws. In addition, Newton explained, with reasonable success, the laws of impact, the tides, and the inequalities of the Moon's motion. So Newton's theory was certainly well confirmed empirically by its successful explanations of established facts.

Newton was also able to make successful predictions, notably as regarded comets. His theory enabled the orbit of a comet to be calculated from a few astronomical readings. The predicted orbit of the comet could then be checked against its actual orbit as revealed by further astronomical readings.

It is interesting to compare the above account of empirical confirmation with that given by Friedman in his 1953 article.⁷ Friedman writes:

'the only relevant test of the *validity* of a hypothesis is comparison of its predictions with experience' (1953, pp. 8-9).

We see from this that Friedman differs from the view, which I have just expressed, by limiting validation of a hypothesis to successful predictions, and hence excluding validation through successful explanations of known facts. However, this exclusion runs counter to normal practice in the natural sciences, and so seems unjustified. As we have seen, Newton's theory was regarded in the early 18th century as confirmed just as much by its successful explanation of facts known to Newton, as by its successful predictions. If the community had limited themselves only to the successful predictions, then Newton's theory might well have not been accepted at all.

In the passage just quoted, Friedman speaks of the 'validity' of a hypothesis, but not of its empirical confirmation. In fact he seems rather doubtful about using the term 'confirmation'. He does use it in the next few lines, but only in scare quotes. This is what he says:

'Factual evidence can never "prove" a hypothesis; it can only fail to disprove it, which is what we generally mean when we say, somewhat inexactly, that the hypothesis has been "confirmed" by experience' (1953, p. 9).

Of course Friedman is quite correct to say that factual evidence can never prove a hypothesis. His scare quotes are here unnecessary. This is just a platitude with which all philosophers of science would agree. Nor do I see why he should use scare quotes for

⁷ Both Rafael Galvão de Almeida and Michel Zouboulakis suggested that it would be helpful, particularly for an audience of economists, to compare my views of empirical confirmation with those of Friedman (1953). The following two paragraphs were added as a result of this suggestion.

confirmed, or regard the use of that word as an example of speaking 'somewhat inexactly'. 'Confirmation' is a term widely used by both scientists and philosophers of science, and there seems no reason to regard it as somehow inappropriate.

Returning now to the example of Newton's theory, we can say that it was certainly well confirmed empirically when it came to be accepted by scientists early in the 18th century. Further results in the 18th and 19th centuries added still further to its empirical confirmation. Thus Newton's theory had two significant features. (1) It contained a great deal of mathematics, and (2) it was strongly confirmed empirically. Kant's mistake was to choose the wrong feature as his criterion for the scientificity of Newton's theory. He thought that it was (1) which made Newton's theory scientific (the Kantian fallacy), while, in reality, it was (2) (the empirical confirmation principle).

That concludes my discussion of the empirical confirmation principle. In the next section, I will examine how it applies to Keynesianism.

4. Keynesianism is Scientific

Keynes, as a student of Marshall's, started as a fairly orthodox economist; but he came to regard standard economic theory as inadequate, especially in the light of the Wall Street Crash of 1929 and the Great Depression which followed. The magnitude of this depression for the period 1929-1935 is shown by the unemployment figures given in Table 1.

Table 1 Unemployment in the USA 1929-1944 (per cent of civilian labour force)

<u>Year</u>	<u>Unemployment</u>
1929	3.2
1930	8.7
1931	15.9
1932	23.6
1933	24.9
1934	21.7
1935	20.1
1936	16.9
1937	14.3
1938	19.0
1939	17.2
1940	14.6
1941	9.9
1942	4.7
1943	1.9
1944	1.2

Source: Baran and Sweezy, 1966, p. 228.

As can be seen, unemployment in the USA rose from 3.2% in 1929 to a peak of 24.9% in 1933, and was still over 20% in 1935 when Keynes was writing *The General Theory*. In this book, Keynes speaks (1936, p. 33) of a 'doctrine ... remained unquestioned by orthodox economists up to a late date' and 'its signal failure for purposes of scientific prediction'. These remarks are quite appropriate. Orthodox Neoclassical economics claims that a market economy will be propelled by market forces to a full employment equilibrium. Now the USA

had a market economy in the period 1929 to 1935, but the figures just quoted show that its behaviour was not at all that predicted by Neoclassical economic theory.

In these circumstances, Keynes set himself the task of devising a theory, which, unlike Neoclassical economics, would explain the Great Depression. He thought that such a theory was needed to restore confidence in the economics profession, because, as he wrote:

‘... professional economists, after Malthus, were apparently unmoved by the lack of correspondence between the results of their theory and the facts of observation; - a discrepancy which the ordinary man has not failed to observe, with the result of his growing unwillingness to accord to economists that measure of respect which he gives to other groups of scientists whose theoretical results are confirmed by observation when they are applied to the facts’ (Keynes, 1936, p. 33).

An interesting feature of this passage is that Keynes implicitly accepts what in section 4 has been called the empirical confirmation principle (**), namely that ‘a theory is scientific to the extent that it is empirically confirmed’. So Keynes’ aim was to produce a theory, which explained the Great Depression and was empirically confirmed and so scientific; but did he succeed in this project? This is what I will next investigate.

Keynes’ theory is well-known, but it will still be useful to give a brief outline of it based on his 1936 book, and a very clear summary of the theory which he published in (1937). The title of Keynes’ 1936 book is: *The General Theory of Employment, Interest and Money*. However, I will focus on those aspects of the theory, which deal with employment. A key concept of Keynes’ theory is that of effective demand, which he divides into demand for consumption goods and demand for investment goods. Keynes produces the key equations (1936, p. 63):

$$\text{Income} = \text{value of output} = \text{consumption} + \text{investment}$$

Since, however, saving = income - consumption, it follows that saving = investment. Part of the aim of *The General Theory* is to show how the equality of saving and investment is brought about.

The next concept which Keynes introduces is that of *the Propensity to Consume*. About this he says:

‘The fundamental psychological law, upon which we are entitled to depend with great confidence both *a priori* from our knowledge of human nature and from the detailed facts of experience, is that men are disposed, as a rule and on the average, to increase their consumption as their income increases, but not by as much as the increase in their income. ... it is also obvious that a higher absolute level of income will tend, as a rule, to widen the gap between income and consumption. For the satisfaction of the immediate primary needs of a man and his family is usually a stronger motive than the motives towards accumulation, which only acquire effective sway when a margin of comfort has been attained. These reasons will lead, as a rule, to a *greater proportion* of income being saved as real income increases’ (Keynes, 1936, pp. 96-97).

So in the equation: $\text{income} = \text{consumption} + \text{investment}$, as income rises the proportion spent on consumption declines, and hence the level of income can only be sustained if there is a corresponding increase in the proportion of investment. As Keynes says (p. 98) we need 'an increase in investment to fill the gap'. After a period of boom based on massive investments, there may come a point where there are no more profitable investment opportunities. Investment will fall rather than rise, and this will produce a fall in output and a rise of unemployment. Income will decline to a level at which, assuming that the propensity to consume remains constant throughout, savings will become equal to the new lower level of investment. This then is Keynes' explanation of the Great Depression. He himself gives the following summary of it:

'The theory can be summed up by saying that, given the psychology of the public, the level of output and employment as a whole depends on the amount of investment. I put it in this way, not because this is the only factor on which aggregate output depends, but because it is usual in a complex system to regard as the *causa causans* that factor which is most prone to sudden and wide fluctuation. ... of these several factors it is those which determine the rate of investment which are most unreliable, since it is they which are influenced by our views of the future about which we know so little.

This that I offer is, therefore, a theory of why output and employment are so liable to fluctuation' (Keynes, 1937, p. 121).

This then is Keynes' theory, but what empirical evidence does he offer in its favour? And does this evidence in fact empirically confirm the theory? To these questions I now turn.

Keynes has argued that the key factor in determining the level of employment is the amount of investment. In his 1936, he considers some statistics regarding investment during the period of the great depression, and these, in effect, are a test of his theory. Before comparing his theory to the data, Keynes stresses that the relevant factor is *net* investment, that is to say gross investment less amounts which are set aside in the form of sinking funds to finance the eventual replacement of the capital equipment which has just been installed. The money in these funds is not spent on consumption goods, and will not be spent on investment goods until the capital equipment is eventually replaced some time in the future. So this money does not contribute to effective demand. As Keynes himself says

'Sinking funds, etc., are apt to withdraw spending power from the consumer long before the demand for expenditure on replacements (which such provisions are anticipating) comes into play; i.e. they diminish the current effective demand and only increase it in the year in which the replacement is actually made. If the effect of this is aggravated by "financial prudence", i.e. by its being thought advisable to "write off" the initial cost *more* rapidly than the equipment actually wears out, the cumulative result may be very serious indeed.

In the United States, for example, by 1929 the rapid capital expansion of the previous five years had led cumulatively to the setting up of sinking funds and depreciation allowances, in respect of plant which did not need replacement, on so huge a scale that an enormous volume of entirely new investment was required merely to absorb these financial provisions; and it became almost hopeless to find still more new investment on a sufficient scale to provide for such new saving as a wealthy community in full

employment would be disposed to set aside. This factor alone was probably sufficient to cause a slump. And, furthermore, since 'financial prudence' of this kind continued to be exercised through the slump by those great corporations which were still in a position to afford it, it offered a serious obstacle to early recovery' (Keynes, 1936, p. 100).

Keynes employs economic statistics for the United States in the years 1919-1933, compiled by Kuznets. Kuznets uses 'capital formation' for what Keynes calls 'investment', but this is just a terminological point, and I will continue to use Keynes' terminology. Kuznets does, however, distinguish between gross and net investment, along the lines of the passage from Keynes just quoted. Kuznets' figures for net investment in the years 1929-1933, as quoted by Keynes, are given in Table 2.

Table 2 Net Investment in the United States 1929-1933 (Millions of Dollars)

1929	25,481
1930	19,036
1931	11,098
1932	1,237
1933	6,675

Source: Keynes, 1936, p. 103.

Comparing these figures with the figures for unemployment in the same years, we can see that they strongly confirm Keynes' theory. Table 2 shows a catastrophic decline in net investment which fell to less than 5% of its 1929 value in 1932, and had only recovered to 28% of its 1929 value in 1933. Such a fall in net investment would, according to Keynes' theory, certainly produce a dramatic increase in unemployment such as is shown in Table 1 for the corresponding years.

Keynes also quotes figures for Great Britain compiled by Colin Clark for the years 1928-1931. These are given for the years 1929-1931 in Table 3.

Table 3 Net Investment in Great Britain 1929-1931 (Millions of £)

1929	296
1930	183
1931	43

Source: Keynes, 1936, p. 102.

The picture here is the same. Net investment by 1931 had dropped to less than 15% of its value in 1929. The conclusion then is that Keynes' theory explains the Great Depression, and is empirically confirmed by economic data. However, as has been stressed above, empirical confirmation arises out of both successful explanations and successful predictions. Let us next examine how Keynes' theory fared as regards predictions.

In response to the great depression, the US president Franklin D. Roosevelt introduced the New Deal (1933-36). This involved a considerable increase in government spending, a large part of which was for investment in public works. The most notable of these public works was the Tennessee Valley Authority, a project of dam construction to curb

flooding and generate electricity. This is quite striking in view of current concerns about global warming. In addition to this public investment, the New Deal provided relief for the poor and unemployed. According to Keynes' theory this too would be helpful since it would tend to increase the demand for consumption goods, since the poor and unemployed have a very high propensity to consume. In fact it is likely that all the relief received by such groups would be spent on consumption. So Keynes' theory definitely predicted that the New Deal would decrease unemployment. According to Baran and Sweezy:

'Measured in current dollars, government spending increased from \$10.2 billion in 1929 to \$17.5 billion in 1939, more than 70 per cent' (1966, p 162).

Table 1 shows that unemployment decreased from its peak of 24.9% in 1933 to 17.2% in 1939, a decrease of 31%. The result of the New Deal thus confirms Keynes' theory. On the other hand, an opponent of Keynes might argue that this confirmation is not very striking since, despite the big increase in government spending, the recovery was not so great, and perhaps might have happened anyway. To this, a Keynesian would obviously have replied that the increase in government spending was not sufficient to restore full employment. Events after 1939 showed that this Keynesian argument was correct.

Following the entry of the United States into the Second World War, government spending increased from \$17.5 billion in 1939 to a maximum of \$103.1 billion in 1944. This time the increase was not 70%, but 489%. Table 1 shows that unemployment dropped steadily from 17.2% in 1939 to 1.2% in 1944 – a very striking confirmation of Keynes' theory.

As we have seen then, Keynes' theory was strongly confirmed both by its successful explanation of the Great Depression, and by the successful predictions it made regarding the recovery from this depression. This, I think, is sufficient to show that Keynes' economic theory should be regarded as scientific. However, the same conclusion is also reached by more recent work within the Keynesian paradigm. In this context, the analysis of Chick and Pettifor (2011 and 2016) is particularly striking, because it uses economic statistics collected over a long period of time. I will therefore conclude this section with a brief account of Chick and Pettifor's work.

On 15 September 2008, Lehman Brothers collapsed provoking a worldwide economic crisis. This was obviously quite similar to the Wall Street crash of 1929, which led to the Great Depression. Now policies based on Keynes' theory had, as we have seen, been very successful in producing a recovery from the Great Depression. So it seemed to many Keynesian sympathisers that similar policies could be used to deal with the aftermath of the Lehman Brothers collapse. This would have meant increasing public expenditure through investment in public works. In May 2010 a coalition government of the conservatives with the liberal democrats came to power in the UK. Its chancellor of the exchequer, George Osborne rejected this Keynesian approach to the crisis. In fact the Conservative Party, of which Mr Osborne was a member, had campaigned on the need to cut public expenditure. Their argument was that the national debt had been greatly increased by the need to bail out the banks in the wake of the Lehman Brothers collapse. In 2009 it stood at 68% of GDP, and thus, the conservatives argued, must be reduced, which could only be done by cutting public expenditure. Keynesian policies of expanding public expenditure could simply not be afforded. If a household falls into debt, they argued, it has to retrench and cut back its expenditure until the debt is paid off. Similarly the UK as a whole must retrench and cut public expenditure. Naturally the Keynesians replied that this was an instance of what is called the fallacy of composition. This fallacy is based on the assumption that, if a whole is composed of parts, what is true for each part must be true for the whole. However, there are many counter-

examples to this assumption. For example, animals and plants are composed of atoms. Atoms are not living, but it does not follow from this that animals and plants are not living.

Still, the argument that households have to cut back in order to pay off debts, and that the same must therefore hold for the country as a whole had great appeal for common sense, and persuaded a lot of citizens of the UK to vote for the conservatives. It also persuaded Mr Osborne to adopt the austerity policy of cutting back on public expenditure.

This situation led Chick and Pettifor to investigate, within a Keynesian framework, the question of whether it was really the case that cutting public expenditure would reduce the level of the public debt. What is interesting to note here is that there has been a shift of focus away from the question of reducing unemployment to that of reducing the national debt. The approach which Chick and Pettifor adopted was first to examine over a hundred years of data about the UK economy 1909-2009, and to see what this data showed about the relationship between government spending and the national debt. Their results are rather surprising. They define (p. 3): 'fiscal consolidations' as 'episodes when government spending actually fell in money terms' and go on to say:

'Outcomes for the public finances are seen as running almost entirely contrary to today's conventional wisdom, which is derived from microeconomic thinking: when sustained, fiscal consolidation increases rather than reduces the public debt ratio and is in general associated with adverse macroeconomic conditions. The analysis is extended to the post-war era, in which government expenditure never actually falls, but the pattern is sustained: when expenditure rises comparatively rapidly, the debt ration falls and the economy prospers, and when it levels off, the debt ration worsens and macroeconomic indicators are less favourable' (Chick and Pettifor, 2011, p. 3).

And again:

'There is a very strong negative association between government expenditure and the government debt, excluding the two outliers for the World Wars. As public expenditure increases, public debt falls, and *vice-versa*. ... Even in war, when the debt ratio rises, it does so by a good deal less than the increases in government expenditure' (Chick and Pettifor, 2011, p. 5).

Chick and Pettifor express the relationship between government expenditure and national debt by means of a regression equation (2011, p. 5), but, rather than laying exclusive emphasis on this mathematical approach, they give a qualitative analysis of the data for the UK economy from 1909 to 2009, dividing these years into periods of fiscal consolidation and fiscal expansion. I will give a brief summary of some of their results.

The first period of fiscal consolidation is 1918-1923, known as 'Geddes Axe'. Here government expenditure fell from £1850 million (35.3% of GDP) in 1918 to £483 million (11.0% of GDP) in 1923. Government debt as a percentage of GDP rose from 114% in 1918 to 180% in 1923 (Chick and Pettifor, 2011, p. 8).

The second period of fiscal consolidation is 1931 to 1933, and was the UK government's initial response to the Great Depression. Government expenditure fell from £575 million (13.2% of GDP) in 1931 to £514 million (12.1% of GDP) in 1933. Government debt as a percentage of GDP rose from 173% in 1931 to 183% in 1933 (Chick and Pettifor, 2011, p. 10).

The third period of fiscal consolidation is 1944-47, when the UK was switching back from a war economy to a peacetime economy. Government expenditure fell from £5,206 million (50.7% of GDP) in 1944 to £2,156 million (20.2% of GDP) in 1947. Government debt as a percentage of GDP rose from 194% to 245% (Chick and Pettifor, 2011, p. 13). However, Chick and Pettifor also point out that the particular years 1946 and 1947 do constitute an exception to their general rule. In 1946, government expenditure was £2,575 million (25.9% of GDP), and Government debt was 252% of GDP. Comparing this with the figures for 1947 given above, we see that government expenditure was reduced between 1946 and 1947, while most unusually government debt also fell. This anomaly is, however, easily explained by the switch from war production, much of it carried out by the government, to more normal peacetime consumer production, much of which was carried out by the private sector.

By way of contrast, we can give the long period of post-war fiscal expansion from 1947 to 1975 (Chick and Pettifor, 2011, p. 14). Here government expenditure rose steadily from £2,156 million (20.2% of GDP) in 1947 to £28,963 million (27.1% of GDP) in 1975, while government debt declined equally steadily from 245% of GDP to 45% of GDP. It is worth noting that at the beginning of this period in 1947 government debt stood at 245% of GDP and yet it was perfectly possible to apply Keynesian policies of increasing public expenditure while at the same time reducing national debt. This shows the falsity of George Osborne's claim that the national debt of 68% of GDP in 2009 made it impossible for the country to afford Keynesian policies of increasing public expenditure. How could a national debt of 68% of GDP be too high for policies which were applied so successfully when the level of the national debt as 245%?

Chick and Pettifor sum up by saying:

'The empirical evidence runs exactly counter to conventional thinking. Fiscal consolidations have not improved the public finances. This is true of all the episodes examined, except the consolidation after World War II, where action was taken to bolster private demand in parallel to public retrenchment' (2011, p. 18).

Chick and Pettifor's conclusions are certainly established by the empirical data collected over so many years. Yet they are also very surprising, and, as we have seen, run counter to common sense. How are these conclusions to be explained? Chick and Pettifor go on to show that they are explained by Keynes' theory (2011, p. 21). This successful explanation of results based on data for the UK economy from 1909 to 2009 clearly gives strong empirical confirmation to Keynes' theory. This is not the end of the matter, however, since Chick and Pettifor's analysis leads to predictions, as I will now explain.

In order to reduce the UK's national debt in 2010, Chick and Pettifor advocated the Keynesian policy of increasing public expenditure, while George Osborne adopted exactly the opposite policy of cutting public expenditure. The prediction of Chick and Pettifor, on the basis of Keynes' theory and their empirical data, was that Mr Osborne's policy would increase rather reduce the UK's national debt. By 2016 it was possible to decide on the basis of economic statistics whether this prediction was correct. In fact, as Chick and Pettifor (2016, p. 5) point out, George Osborne relaxed his policy in late 2012. Nonetheless cuts in public expenditure continued though not on such a grand scale as originally planned. What were the results of this policy? The relevant data are given in Chick and Pettifor (2016, p. 6). Public spending as a percentage of GDP steadily decreased from 25.0% of GDP in 2010 to 22.2% of GDP in 2015. Public debt steadily increased from 77% of GDP in 2010 to 89% of GDP in 2015. So it turned out that the prediction of Chick and Pettifor was shown to be completely

correct, and that of George Osborne entirely wrong. As Chick and Pettifor themselves say:

‘On the basis of what happened to the public debt ratio, our conclusions have been wholly vindicated. ... Rather than improving, the debt ratio has not stopped rising and in 2015 was within a whisker of 90 per cent of GDP’ (Chick and Pettifor, 2016, p. 6).

We have then a successful prediction, which provides yet more empirical confirmation of Keynesianism.

Two further points can be added. First it is usual to think of an economic theory being confirmed because policy recommendations based on it have proved successful. This was indeed the case with Keynes’ theory and the policy recommendations based on it in the Great Depression. However, in the case of Mr Osborne’s austerity policies, we have a different situation. Mr Osborne’s policies were exactly the opposite of those recommended by Keynesianism, and it was the complete failure of these policies to attain their objective that confirmed the Keynesian paradigm.

A second point is that the success of Chick and Pettifor’s prediction in 2011 gives particularly strong confirmation to Keynesianism, because of a principle which has been developed in philosophers of science working in confirmation theory. The principle states that if a theory T predicts an event e, then if e is very improbable on background knowledge but is actually observed, T receives strong empirical confirmation from the success of this prediction. In Gillies, 1998, p. 157, I attribute the basic idea behind this principle to Popper (1959, Appendix *ix, p. 410), but then go on to show that, with a slightly different formulation from Popper’s, it is accepted by the other main account of confirmation, namely Bayesianism. The standard illustration of this principle comes from physics, and is the following:

‘A nice historical example is provided by the famous test of Fresnel’s wave theory of light. Poisson deduced from this theory that if a ball bearing cast a circular shadow, then, under some circumstances, a bright spot of light should appear at the exact centre of this shadow. This result was regarded as highly improbable on background knowledge, and yet when the experiment was carried out, the bright spot did indeed appear at the centre of the shadow’ (Gillies, 1998, pp. 157-8).

The success of this very surprising prediction was regarded by the physics community as giving very strong empirical confirmation to Fresnel’s theory, and was an important factor in that theory coming to be accepted by most physicists.

Let us compare this prediction in physics with the prediction made by Chick and Pettifor in 2011. As pointed out above, the common sense view was based on the analogy between a household and the country as a whole. If a household falls into debt, it must cut back its expenditure until the debt is paid off. Similarly it is argued (and the argument sounds very plausible): if a country falls into debt, it must cut back its expenditure until the debt is paid off. The claim that cutting back on expenditure will actually increase the national debt runs just as contrary to common sense as the claim that a bright spot will appear in the centre of a dark shadow. In both cases a correct prediction contradicting common sense gives very strong empirical confirmation to the theory on which the prediction is based.

The empirical confirmation of the recent work of Chick and Pettifor shows once again that Keynesianism is scientific. This additional recent empirical confirmation is important for the following reason. It may be that the laws of physics do change, but, if so, it is at a rate,

which is very slow by the scale of human life. Galileo obtained empirical confirmation of his law of falling bodies in the late 16th and early 17th centuries. In the 400 or so years, which have passed since then, it is most unlikely that the law of falling bodies would have changed. On the other hand, the world economy has changed out of all recognition during this time. Economic theories can only apply to a particular economic system, and may therefore no longer apply if that economic system changes. Keynes' theory applied very well to the UK and US economies in the period 1930 to 1945. It was empirically confirmed by data about these economies and was shown to be perfectly scientific. Since 1945, however, there have been very considerable changes to both the UK and US economies. Above all, there has been the rise of the transnational companies that now have a dominant role in the economies of both countries. It is thus no longer certain that Keynesianism still applies today. However, the work of Chick and Pettifor shows, that, despite the changes mentioned, Keynesianism does still apply. A theory in this paradigm has been empirically confirmed just as much by recent evidence as by earlier evidence, and so should definitely be regarded as a scientific.

5. Conclusions

In section 4 I have argued that that Keynesianism is scientific, while in section 1 I argued that all paradigms in economics, including the Keynesian, are ideological. If both these claims are correct, it follows that a paradigm (or theory) in economics can be both ideological and scientific. This conclusion may seem surprising at first, but, if we consider the criteria of being ideological and the criteria for being scientific, it becomes clear that both sets of criteria can be satisfied in a particular case. A theory is ideological if its conclusions, e.g. government intervention in the free market can be justified, form part of a political ideology contradicted by other political ideologies; and also if some of its theoretical concepts, e.g. a shortfall in investment, involve values which are ideological in character. By contrast a theory is scientific if it is empirically confirmed by data. Now reflection shows that it is perfectly possible for a theory to satisfy the criteria for being ideological, but also those for being scientific.

This point is an important one, because many economists, e.g. Friedman and Robbins, have thought that a theory being ideological prevents it from being scientific. They have therefore tried to create a 'positive economics' which consists of factual statements involving no values or ideology. These attempts have ended in failure. In fact the 'positive' economics of both Friedman and Robbins turns out to involve a strong right wing ideology. Moreover the attempt to construct a positive economics was unnecessary since an economic theory can be scientific even if it is ideological.

Although the Neoclassical paradigm cannot constitute a positive economics, Neoclassical economics might, like Keynesianism, be scientific as well as ideological. To investigate whether this is the case lies beyond the scope of this paper, but some material relevant to the question is contained in Gillies (2012).

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SUGGESTED CITATION:

Gillies, Donald (2020) 'The Empirical Success of Keynesianism' *Economic Thought*, 9.1, pp. 24-43.
<http://www.worldeconomicsassociation.org/files/journals/economicthought/WEA-ET-9-1-Gillies.pdf>

Comment on ‘The Empirical Success of Keynesianism’ by Donald Gillies

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The study of how ideology impacts economic theory helps to shed light on the nature of economic theory itself. I have tackled these issues in my own PhD Dissertation (Almeida, 2019a), and I appreciate this opportunity to comment on Professor Gillies’ article which provides an interesting perspective from an author with training in philosophy.

Economists important to the development of the discipline have dedicated themselves to issues of ideology. Robbins (1932) and Friedman (1953), two of the most important trend-setters in economics, provided dialogue between economics and philosophy. Robbins, when he defined economics as ‘the science which studies human behaviour as a relationship between ends and scarce means which have alternative uses’ (Robbins, 1932, p. 15), has allowed the expansion of the range of economic analysis through its method; Friedman argued for pragmatism in the models, in which results are more important than premises.

I believe that no discipline has ever persisted so *strongly* in its claims to be value-free as economics (cf. Aldred, 2009). This is true even of physics, often viewed as *the* ultimate science to be emulated by other branches of science, leading to accusations of ‘physics envy’ (Nelson, 2015). The attempt to make economics value-free has been a concern of economists, as early as the 18th century (Colander and Su, 2015; Waterman, 2020).

This has influenced how economists build their models. Jean-Jacques Laffont, one of the most important names in applying general equilibrium models to public economics, wrote that most economists have chosen to ignore the interaction between economic policy and politics because of ideology, and that ‘some even believe that it is not “politically correct” to develop policy recommendations altered by political considerations’ (Laffont, 2000, p. 5; Almeida, 2019a, p. 109).

Robbins established (neoclassical) economics as non-ideological and value-free (assuming we can consider ‘value judgements’ and ‘ideology’ to be synonyms). In essence, he helped economic theory to become what it is today, and this is the subject of Professor Gillies’ critique. Robbins wrote:

‘No less an authority than Gunnar Myrdal has devoted a whole book to the argument that, explicitly or implicitly, all propositions of economic theory, all classifications of happenings having an economic aspect, must involve judgments of value. I do not agree with this position. I don’t think that the proposition that, if the market is free and demand exceeds supply, prices will tend to rise, has any ethical content whatever’ (Robbins, 1981, p. 4)

And this is the view of many economists. The question is: why would Robbins be wrong?

Robbins himself made a distinction between value-free ‘economics’, and ‘political economy’ where one ‘should not only include, but should necessarily embrace’ values

¹ This is a modified version of the comment available at the site, adjusted in order to take into consideration the changes made by Professor Gillies. See my original comment at <http://etdiscussion.worldeconomicassociation.org/papers/ideology-and-science-in-economic-theory/>

(Colander, 2009, p. 438). Taking heed of Laffont's diagnosis, many economists working on political models (such as the ones in the New Political Macroeconomics tradition, for example) have attempted to make more 'ideology-free' models. They did this because they considered earlier public choice models to be too ideological in the libertarian sense,² and aimed for value-free models capable of describing political economy as it is (Almeida, 2019a, chapter 3). So, does Professor Gillies imply that their efforts have failed? Yes, 'the arguments of Robbins are not very convincing'.

I might be going off on a tangent, but it should be noted that the pendulum swings a lot: back in the 1950s, economics was more interventionist. In the socialist calculation debate, socialists used neoclassical tools to show the superiority of a centrally planned economy, and Jan Tinbergen's theory of economic policy developed models for optimal state intervention. Free-market economics was considered heterodox, even 'ideological' (Almeida, 2019b; Backhouse, 2010). Bockmann (2013) has shown that the economics of the capitalist West and the socialist Iron Curtain were similar, with the former trying to escape the politics of McCarthyism and the latter, the politics of Stalinism.³

Keynes himself was aware of the fact that economics is a moral science, therefore embedded in values. It was one of the main reasons why he criticised the budding econometrics movement (Keynes, 1939; Almeida, 2016). Keynes started to show his dissatisfaction early in the *Economic consequences of peace*, and this is present throughout his 1920s writings (Keynes, 1930; 1932). In his *Treatise on Money*, in a chapter he wrote in 1927, he gave his opinion on index prices:

'The Jevonian concept would have been intellectually delightful and of great scientific convenience if it had been based on a true analysis. It is one of the several quasi-mathematical economic conceptions, borrowed by analogy from the physical sciences, which seemed likely to be so fruitful when they first devised fifty or sixty years ago, but which have had to be discarded on further reflection, in whole or in part' (Keynes, 1930, v. 1, p. 78).

That being said, one of the main contributions of Professor Gillies's article is its exposition of the Kantian fallacy. From his reading, it seems Kant presented one of the earliest cases of 'physics envy'. The Kantian fallacy has a subtle presence in economic debates. V. V. Chari, in a Senate hearing on the causes of the 2007-8 crisis, said that 'If you have an interesting and a coherent story to tell, you can do so within a DSGE [dynamic stochastic general equilibrium] model. If you cannot, it probably is incoherent' (Chari, 2010, p. 32). Therefore, 'from this perspective, there is no other game in town' (ibid., p. 35). Large, robust and even beautiful models dominate the economic landscape, and yet they need to be built on the awareness that mathematisation is not the only feature that makes them scientific.

Model makers must be aware of the Kantian fallacy. This is behind Keynes's critique of Tinbergen and econometrics (Keynes, 1939). Proper econometrics must take into consideration both the proper style of mathematics, if any maths is necessary, and its empirical validation. However, even neoclassical economists are finally starting to realise that the use of mathematical and econometric models does not give full protection against ideology (Azam, 2019). 'Ideology' should not be grounds for rejecting any theory.

² Public choice theorists themselves have denied such accusations and have defended their approach as value-free as well (Boettke and Piano, 2019). I have argued elsewhere that public choice theorists have had little success in defending the value-free status of their discipline (Almeida, 2019a, chapter 6.2).

³ However, see Weintraub (2017) for a critique of the interpretation that the mathematisation of economics happened to escape McCarthyism.

As a final comment, Professor Gillies wrote that ‘the “positive” economics of both Friedman and Robbins turns out to involve a strong right wing ideology’. Although some authors would point to the fact that economists themselves are not openly right wing, even citing prominent leftist economists (e.g. Klein and Stern, 2007), it is the impression that remains. George Stigler recognised this, and, in a polemical essay (Stigler, 1959), he argued that economics turns people more conservative. Stigler’s essay is usually considered a curiosity in the history of economic thought nowadays, but I wonder if it is because of its provocative assertion? It can be said that it does not serve the cause of a profession, seeking to defend their discipline as value free, to call attention to it. Consequently, the structure of neoclassical economic theory continues rigid, enamoured by the serviceability of its method, at the cost of empirical confirmation.

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SUGGESTED CITATION:

Almeida, Rafael Galvão de (2020) 'Comment on "The Empirical Success of Keynesianism" by Donald Gillies.' *Economic Thought*, 9.1, pp. 44-47.
<http://www.worldeconomicsassociation.org/files/journals/economicthought/WEA-ET-9-1-Almeida.pdf>

The Psychological Contributions of Pragmatism and of Original Institutional Economics and their Implications for Policy Action

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Abstract

The aim of this work is to illustrate the psychological contributions of Pragmatism and of the Original Institutional Economics (also referred to as OIE or institutionalism), and their relevance for improving the process of social valuing and, as a consequence, the effectiveness of policy action. As a matter of fact, both institutionalist and pragmatist theories were well acquainted with various strands of psychology, and some of them also provided relevant contributions in this respect. Moreover, these theories reveal, along with various differences, significant complementarities, both between themselves and with important concepts of social psychology and psychoanalysis. The work will address the following aspects:

(I) The main characteristics of pragmatist psychology with particular attention to their social implications. For space reasons, we will focus attention on the contributions of authors – John Dewey, William James and George Herbert Mead – more oriented to social sciences.

(II) The psychological contributions of institutionalism. We will pay particular attention to Thorstein Veblen's theory of instincts and John Rogers Commons' theory of negotiational psychology. We highlight that these theories present, despite a number of differences, relevant complementarities.

(III) The implications of the previous analysis for improving the process of policy formulation. We will address some aspects of the intertwined issues of social valuing and democratic planning. For instance, in devising policies for promoting workers' motivations, the focus will be not only on the monetary side but also on the adoption of measures aimed at promoting participation in the management of their institutions.

Keywords: institutionalism, pragmatism, social valuing, interdisciplinarity, policy action

1. The Main Characteristics of Pragmatist Psychology

1.1 Introduction

In this paragraph we will focus on some relevant contributions of the psychology of pragmatism¹, also in relation to their links with OIE's psychological perspective.

¹ In pragmatism – a philosophical movement which considers thought and action as two related aspects of human life – two main strands can be identified. The first, elaborated by Charles Sanders Peirce, conceives of pragmatism as an analysis of reality that should be based on the objective validation method of the physical sciences. The second, expounded in particular by John Dewey, William James and George Herbert Mead, who – while sharing in various ways Peirce's notion of scientific enquiry – also elaborated a more far-reaching perspective embracing ethics and other more qualitative aspects of society. Needless to say, Peirce too, despite his focus on the method of the physical sciences, made relevant contributions to the social strands of pragmatism. For instance, we can mention the central link he identified between thoughts, perceptions, habits and actions, which exerted a great influence on the

We will chiefly consider some aspects of the contributions of William James and George Herbert Mead. Now we briefly consider Dewey's seminal article (1896), 'The Reflex Arc Concept in Psychology', which has exerted a far-reaching influence, not only in the pragmatist field, but also in the larger domain of the psychological sciences. The main objective of the article is to explain the mechanism of body reactions to external events. A typical example is that of a child and a candle: the child is at first attracted by visual stimulus to touch the candle, but when he got burnt he suddenly withdraw the hand. In this instance, the most obvious explanation, which was elaborated in the notion of reflex arc, assumes a dichotomy stimulus-response, according to which an 'exogenous' factor would trigger a kind of automatic response in the body. In his article, Dewey strongly underscores that such apparently obvious dichotomy is totally fallacious. Moreover, such dualism opens the way to a parallel dichotomy between mind and body which, in turn, lies at the basis of behaviouristic (and positivistic and reductionist) psychology, according to which only external and measurable phenomena are truly 'scientific'.

The reason for the fallacy of the dichotomy stimulus-response rests in the circumstance that, in Dewey's words, 'the so-called response is not merely *to* the stimulus; it is *into* it' (Dewey, 1896, p. 359). In fact, while the stimulus most often originates from external factors, it is also true that such stimulus must be interpreted and mediated by the person according to previous experiences. For instance, in the case of the candle, only the burning experience will teach the boy to withdraw the hand. In this sense, the response is a part of a more ample coordination process, similar not to an arc but to a circuit. In his words,

'It is the coordination which unifies that which the reflex arc concept gives us only in disjointed fragments. It is the circuit within which fall distinctions of stimulus and response as functional phases of its mediation and completion. The point of his story is in its application; but the application of it to the question of the nature of psychic evolution, the distinction between sensational and rational consciousness, and the nature of judgement must be deferred to a more favourable opportunity' (Dewey, 1896, Vol. I, p. 370).

From this passage it emerges clearly that Dewey was well aware of the implications of a more encompassing conception of human action.

1.2 The Principles of Psychology of William James

We will analyse some relevant and intertwined concepts of his psychology.

Habits

The concept of habit has played a key role within the Pragmatist approach and has also significantly influenced institutional economics. In this regard, important contributions were

theories of Veblen and Commons. In Peirce's words, 'The whole function of thought is to produce habits of action... What the habit is depend on *when* and *how* it causes us to act. As for the *when*, every stimulus to action is derived by perception; as for the *how*, every purpose of action is to produce some sensible result. Thus, we come down to what is tangible and practical, as the root of every real distinction of thought, no matter how subtle it may be; and there is no distinction of meaning so fine as to consist in anything but a possible difference of practice' C.S. Peirce, 'How To make Our Ideas Clear', originally published in *Popular Science Monthly* 12 (January, 1878), pp. 286-302. Quotations taken from J. Buchler (ed.) (1955, p. 30), *Philosophical Writings of Peirce*, which contains an ample selection of Peirce's most significant contributions. Interesting remarks on these aspects were provided by Commons (1934, pp. 150-157) in the section on Pragmatism, some of them reported in footnote 12. For more details about the pragmatist perspective refer to Menand (1997).

provided by William James, who, in his *Principles of Psychology*, investigated the role of habits in both the individual and collective dimension. In the individual dimension, the disposition of the person to form habits can be traced to the circumstance that,

‘Man is born with a tendency to do more things than he has ready-made arrangements for in his nerve-centres....If practice did not make perfect, nor habit economise the expense of nervous and muscular energy, he would therefore be in a sorry plight’ (James, 1950[1890], Vol. I, p. 113).

In this sense, the set of personal habits performs the important function of reducing the conscious attention upon them. This entails the apparent paradoxical result that the person, although routinely performing several actions, is largely unable to know *how* he or she has performed them. This concept is expressed in the following passage,

‘We all of us have a definite routine manner of performing certain daily offices connected with the toilet, with the opening and shutting of familiar cupboards, and the like. Our lower centres know the order of these movements, and show their knowledge by their “surprise” if the objects are altered so as to oblige the movement to be made in a different way. But our higher thought-centres know hardly anything about the matter. Few men can tell off-hand which sock, shoe, or trousers-leg they put on first. They must first mentally rehearse the act; and even that is often insufficient—the act must be *performed*’ (James, 1950[1890], Vol. I, p. 115).

The interesting aspect of this analysis is that, in describing some important features of personal habits, it also casts light on the role of collective habits in social dynamics. As a matter of fact, habits constitute the normal way of working not only of personal life but also, in a complex interplay of reciprocal influences, of collective life. The following passages convey these concepts vividly,

‘Habit is thus the enormous fly-wheel of society, its most precious conservative agent. It alone is what keeps us all within the bounds of ordinance, and saves the children of fortune from the envious uprising of the poor. It alone prevents the hardest and most repulsive walks of life from being deserted by those brought up to tread therein. It keeps the fisherman and the deck-hand at sea through the winter; it holds the miner in his darkness, and nails the countryman to his log-cabin and his lonely farm through all the months of snow; it protects us from invasion by the natives of the desert and frozen zones....It keeps different social strata from mixing’ (James, 1950[1890], Vol. I, p. 121).

This analysis of habits is significantly linked to the role that the continual flux of actions plays on their formation. In fact, habits are acquired or eliminated cumulatively and are intimately connected with the system of values of the person. This is related to an important concept of Pragmatism, namely, that individuals do not unfold their personalities in abstract terms but out of their actions in both the individual and collective spheres. In this light, the person is considered as an active agent seeking to attain his or her goals which, however, cannot be reduced to a simple hedonistic principle. These goals, in fact, embrace all the complex set of values and motivations of persons in their interaction with the social structure and, for this reason, should be studied in their evolutionary patterns.

Consequently, habits are not 'neutral and automatic behavioural blueprints' as they carry with them, partly at an unconscious level, all the complex, often conflicting, aspects making up the individual personality. In this sense, habits constitute the 'psychological procedures' through which the emotions, motivations and values of the person find their concrete expression. Thus, it is necessary to continually improve personal behaviour through the acquisition of 'sound habits' and the elimination of bad ones:

'No matter how full a reservoir of *maxims* one may possess, and no matter how good one's *sentiments* may be, if one have not taken advantage of every concrete opportunity to *act*, one's character may remain entirely unaffected for the better... There is no more contemptible type of human character than that of the nerveless sentimentalist and dreamer, who spends his life in a weltering sea of sensibility and emotion, but who never does a manly concrete deed... Every smallest stroke of virtue or of vice leaves its never so little scar. The drunken Rip Van Winkle, in Jefferson's play, excuses himself for every fresh dereliction by saying, "I won't count this time!" Well! He may not count it, and a kind Heaven may not count it; but it is being counted none the less. Down among his nerve-cells and fibres the molecules are counting it, registering and storing it up to be used against him when the next temptation comes. Nothing we ever do is, in strict scientific literalness, wiped out. Of course, this has its good side as well as its bad one. As we become permanent drunkards by so many separate drinks, so we become saints in the moral, and authorities and experts in the practical and scientific spheres, by so many separate acts and hours of work' (James, 1950[1890], Vol. I, pp. 125, 127).

By developing these insights, pragmatist thinkers have stressed in many contributions the twofold nature of habits. Indeed, habits embody and synthesise, in an evolutionary way, the principles, values and knowledge accumulated over time. In this sense, they exhibit in every context both the ceremonial and instrumental aspects pointed out by institutional economists (later in the paper).

Other Relevant Concepts: Emotions, Instincts, Will

We will now make a sketch of some other relevant concepts developed by James, especially in his *Principles of Psychology*. Surely one of most famous is his theory of emotions. Here he puts forward the counter-intuitive hypothesis that, in presence of an emotion stirred up by an external event (e.g., fear, anger, etc.), it is not the mental perception that engenders bodily modification – for instance, trembling in case of fear and swelling and contraction in case of anger – but it is the other way round. Namely, it is bodily excitation that engenders and reinforces mental reactions.

The gist of his view is that emotion is a feeling of bodily state and is related to a purely bodily cause. By this he does not mean that the mental states are irrelevant, but that they have in bodily reactions their central medium. In fact, a mental state without bodily changes would amount to a pure intellectual activity. One can agree more or less with this theory. Probably, it is a bit of an exaggeration to say that if we run away from a lion we are afraid only because we run. It seems more reasonable to suppose that if we see a lion, mental and bodily reaction reinforce each other. In this sense, James's intuition that the more we run the more we are afraid; and the corresponding pedagogical maxim that a bodily

control of our emotions can help control the expression of the emotions, is true.

For instance, if we are angry at someone's behaviour and then start shouting, this is likely to reinforce in an uncontrolled way our anger. This is true, of course, but we also believe that too much repression can be negative as well. Anyway, whatever might be the true sequence of mental-bodily reaction, the pertinence of his analysis rests in introducing a holistic approach to the study of psychological phenomena. This allows us to consider in a more integrated way the links between mind and body and the cognitive and emotional aspects of the person.

Related to his analysis of emotions stands his theory of instincts. Here he makes the interesting observation that almost all human instincts are made up of a pair of opposites: for instance, audacity and timidity, liveliness and apathy, sociability and aloofness, love and hate, solicitude and indifference. These instincts are in dialectical struggle, and the prevalence of one or other aspect depends on a host of internal and external circumstances. Among the latter, social habits play a central role in inhibiting some instincts and/or directing their expression in a socially approved way.

A significant implication of this analysis is that, contrary to what may appear at first sight, people often behave in a more uncertain and conflicting way, not because they are less 'instincts-driven', but because their instincts are more numerous and complex than those of animals. In this sense, an action driven by instinct cannot be opposed by 'reason', but by a contrary instinct. However, reason can help the 'right instincts' to make their way in shaping human personality. Another relevant factor in this process is the effort related to will. Here James notes that, while it is always arduous to know the degree of freedom of human will, such freedom increases with the prevalence of the bright aspects of personality.

In this sense, 'will is a relation to the mind and its ideas....with the prevalence, once there as a fact, of the motive idea, the *psychology* of volition properly stops...the *willing* terminates with the prevalence of the idea' (James, 1950[1890], Vol. II, p. 560).

Another interesting field of application of this theory pertains to human motivation. Here James clearly departs from a hedonistic approach by noting that the related criteria of searching pleasure and avoiding pain are by no means the sole drivers of human action. In fact, the realms of instincts and emotions are driven by totally different principles. In the former case, as noted before, by a functional criterion and in the latter instance, by a set of forces much more complex than mere hedonism. In his words,

'If a movement feels agreeable, we repeat and repeat it as long as the pleasure lasts. If it hurts us, our muscular contractions at the instant stop... so widespread and searching is this influence of pleasures and pain upon our movements that a premature philosophy has decided that these are our only spur to action... this is a great mistake, however. Important as is the influence of pleasures and pains upon our movements, they are far from being our only stimuli. With the manifestations of instincts and emotional expression, for instance, they have absolutely nothing to do... [for instance]... who smiles for the pleasure of the smiling, or frowns for the pleasure of the frown? Who blushes to escape the discomfort of not blushing?' (James, 1950[1890], Vol. II, p. 550).

Hence, if we have to identify a more encompassing criterion accounting for human motivation, this can be located in the interest attached by the person to various groups of action. This 'interest' is something decidedly more multifarious than a simple pleasure/pain dichotomy. In fact,

‘The “interesting” is a title that covers not only the pleasant and the painful, but also the morbidly fascinating, the tediously haunting, and even the simply habitual, inasmuch as the attention usually travels on habitual lines, and what-we-attend-to-do and what-interest-us are synonymous terms’ (James, 1950[1890], Vol. II, p. 559).

Further Remarks

As can be seen from the previous account, William James provides a far-reaching theory of relevant psychological phenomena. Perhaps for the first time, the bodily and mental dimensions of psychological phenomena have been treated in a systematic way.

This goes in tandem with an analysis of the cognitive and emotional aspects of human personality, which renders possible a consideration of the role of conflicts in mental life. From this, a number of significant implications for individual and collective life are drawn. The analysis of habits is of particular significance, as it contributes to explain the relative sticky and past-binding nature of individual and collective behaviour.

There are also in James’s theory some weaker aspects. One of them refers to a certain lack of relational content in his psychology: in fact, there is little explanation of what factors – from the birth onwards – would lead a person to interact with others and with what effects on his/her intellectual and emotional life. The psychological conflicts are appraised, in a ‘Faustian’ spirit, like a struggle between good choices and bad choices – for instance, between drinking and being sober – in rather abstract moral terms.

True, there is an analysis of the various ‘selves’ of the person and of the possible conflicts between them: for instance, notes James, one cannot be, at the very same time, a sports champion, a scientist, a musician and an adventurer. Hence, there is a trade off (namely, a conflict) between various objectives. However, these choices – and in particular the most dysfunctional ones, like drinking too much – seem to bear no clear relation to the economic, social, or psychological aspects of the person’s living context.

Also for this reason, his theory does not deal enough with the analysis of the collective life and of the possibilities of social change. For instance, after saying that habit, ‘saves the children of fortune from the envious uprising of the poor... [and that]... keeps different social strata from mixing’, he remarks that, in the main, such an outcome is better for social life – but he does not explain why. Relatedly, in discussing the social unrest of his time, he notes that a better dialogue between social classes could improve the situation, but he does not seem to believe in any structural change of capitalistic societies.

Last but not least, James’s account of the tangled issue of the scientific character of psychology is somewhat influenced by positivism. In fact, he states in the preface of *The Principles of Psychology* that,

‘This book, assuming that thoughts and feelings exist and are vehicles of knowledge, whereupon contends that psychology when she has ascertained the empirical correlation of the various sorts of thought and feeling with definite conditions of the brain, can go no farther – can go no farther, that is, as a natural science. If she goes farther she becomes metaphysical... this book consequently rejects both the associationist and the spiritualist theories; and in this strictly positivistic point of view consists the only feature of it for which I feel tempted to claim originality... [then he adds, probably not very convinced about this aspect]... Of course this point of view is anything but ultimate’ (James, 1950[1890], Preface, Vol. I, p. vi).

Then, he goes on by remarking that he certainly appreciates metaphysics but that nonetheless it cannot be considered as a science. This opinion, however, flies against his overall treatment of psychological phenomena – in particular, feelings and emotions – which is inherently qualitative in nature.

Here we can note that James's position – oscillating between positivism and a more humanistic approach – is typical of the social scientists of the early 20th century (and also, to a degree, of our time). How can we go beyond the reductive dimension of positivism in psychology and in the social sciences? A simple path could be the following: if we consider as scientific not only quantitative/measurable phenomena, but everything going on in our inner and external world, then it follows that also qualitative aspects, – for instance, the emotional life of a person, literary criticism and the assessment of students in music schools – although not amenable to quantitative assessment, can be nonetheless, in our view, scientifically investigated. Needless to say these assessments will tend to be more indirect and uncertain than clear-cut (but most often quite illusory) measurable scientific evidence, but this depends on the complexity of the issues addressed.

1.2. The Social Psychology of George Herbert Mead

Introduction

In this context, the social psychology (also indicated as 'symbolic interactionism') of George Herbert Mead appears quite significant for our theme.

He brings together philosophical and psychological aspects to an analysis of the dynamics of the human mind and social evolution. Perhaps more than other pragmatist authors, he places the analysis of the human mind in its social context, to the point that individual and collective aspects appear as two dimensions of a manifold but unitary phenomenon.

This approach is closely related to the intense activity that Mead performed as a social reformer. We will analyse, without any claim of completeness, some relevant aspects² of his theory of the 'social self'.

The Theory of Social Self

A good starting point is the article 'The Mechanism of Social Consciousness', where he makes interesting remarks on the definition of 'social object' and its link with the development of personality. In his words,

'The social object will then be the gestures, i.e., the early indications of an ongoing social act in another plus the imagery of our response to that stimulation... In the organisation of the baby's physical experience the appearance of his body as a unitary thing, as an object, will be relatively late, and must follow upon the structure of the objects of his environment. This is as true of the object that appears in social conduct, the self... The child's early social percepts are of others. After these arise incomplete and partial selves – or "me's" – which are quite analogous to the child's percepts of his hands and feet, which precede his perception of himself as a whole... [and such perception can be realised only when]... the child is able to experience

² We will employ to that purpose the book edited by Andrew J. Reck *Selected Writings – George Herbert Mead*, Chicago: University of Chicago Press, 1964. All the quotations are taken by such reference.

himself as he experiences other selves' (Mead, ['The Mechanism of Social Consciousness', 1912] in Reck, 1964, pp. 137, 138, 139).

Hence, not until the person interiorises the role of others does he/she develop a complete self-consciousness. This implies the capacity to observe and talk to oneself. In this sense, 'the "me" is a man's reply to his own talk', (Mead in Reck, 1964, p. 140).

The 'me' of a person, then, is formed gradually out of the process of his/her development. Such 'me', however, which constitutes in a way the psychoanalytic *ego*, does not exhaust the mental life of the person. There are in fact other instances, indicated by Mead as the 'I', and that broadly corresponds to the psychoanalytic notion of the 'unconscious', that are no less important in psychic life. In this sense,

'The "I" therefore never can exist as an object in consciousness, but the very conversational character of our inner experience, the very process of replying to one's own talk, implies an 'I' behind the scenes who answers to the gestures, the symbols, that arise in consciousness. The "I" is the transcendental self of Kant, the soul that James conceived behind the scenes holding on to the skirts of an idea to give it an added increment of emphasis' (Mead in Reck, 1964[1912], p. 141).

In a cognate article, 'The Social Self', Mead carries on with the previous analysis by underscoring the capacity of the human mind for self-observation: a process whereby both the observer and the observed appear and where the 'me' can observe the 'I' acting.

Of course, the observing instance can remain in some way unconscious. Moreover, we can certainly observe us when speaking, but this detracts from the spontaneity of the act. Indeed, it is more difficult to observe our speech if we are emotionally involved.

However, in normal circumstances this capacity to observe and assess our behaviour allows for the emergence of the social self. In his words,

'The self which consciously stands over against other selves thus becomes an object, another to himself, through the very fact that he hears himself talk, and replies. The mechanism of introspection is therefore given in the social attitude which necessarily man assumes toward himself, and the mechanism of thought, insofar as thought uses symbols which are used in social intercourse, is but an inner conversation', (Mead, ['The Social Self', 1913], in Reck, 1964, p. 146).

The interest of this analysis lies in the circumstance that it wonderfully blends the individual and social aspects of human psychology. For instance, the capacity of the person to respond to his/her own inner talk implies the capacity of the self to take the role of others (or of a 'generalised other') in the case of widely shared opinions.

This capacity also constitutes an essential ingredient of child development. In this regard, notes Mead, the capacity of the child to acquire the role of parents cannot be reduced to mere imitation, since it represents for the child a way for getting acquainted with its social world. In this respect,

'Not that we assume the role of others toward ourselves because we are subject to a mere imitative instinct, but because of in responding to ourselves we are in the nature of the case taking an attitude of another than the self that

is directly acting, and into this reaction there naturally flows the memory images of the responses of those about us....thus the child can think about his conduct as good or bad only as he react to his own acts in the remembered words of his parents' (Mead in Reck, 1964[1913], p. 146).

As one can easily note, this process carries a striking resemblance with important psychoanalytic³ concepts.

Now we will consider the implications of this reasoning for the psychology of ethics and social change.

He starts with the interesting remark that persons, when they have to confront themselves with new values, first direct attention to the external objects embodying such values, and only afterwards do they become aware of the inner change required to embrace the new values. Hence, only when the self becomes an object to itself, can we observe and assess our behaviour.

At this stage, changes in the external objects and in the self are co-extensive. Such a process implies a conflict between different systems of values, often ending up in a transformation of personality. More precisely,

'certain values find a spokesman in the old self or in the dominant part of the old self, while other values answering to other tendencies and impulses arise in opposition and find other spokesmen to present their cases. To leave the field to the values represented by the old self is exactly what we term selfishness' (Mead in Reck, 1964[1913], p. 148).

What will be the result of this struggle between conflicting tendencies? One outcome is the prevalence of the subjective aspects of the question. In this case the prevalence of one tendency (e.g., the old or the new) is seen as a corresponding sacrifice of the other.

Conversely, when the issue is addressed in objective terms, the conflict between old and new self ends up in a reconstruction of the situation and the parallel formation of a new personality.

This process, notes Mead, is similar to the abandonment of old theories brought about by scientific discoveries. The main difference between scientific and social realms is that in the latter – being intrinsically tied to ethics and morality – a more complete involvement of self is likely to arise.

In this respect, 'the growth of self arises out of a partial disintegration, – the appearance of different interests in the forum of reflection, the reconstruction of the social

³ We can mention the complex processes, starting from infancy, of (i) identification/differentiation in interpersonal relations, and of (ii) internalisation of norms and values in the formation of individual and social identity, to which broadly corresponds the formation of the *ego* and of the *superego*. The latter arises from the internalisation of the prohibitions and of the moral and cultural values – as perceived by the child – of the child's parents and also of later institutional figures such as teachers and opinion leaders (see also footnote 12). However, whereas in non-neurotic situations, the 'code of conduct' emerging from such tendencies asserts itself as a genuine behaviour, in neurotic situations, leading to the formation of *superego*, things run in a completely different way. In fact, on account of the sense of guilt arising from the child's aggressiveness towards its caretakers, a good portion of such aggressiveness is directed towards the child's *ego* in the role of a controlling and punitive instance. From this aspect stems the severity, rigidity and inflexibility of the *superego*. However, these characteristics of *superego* are able neither to create a better environment for the person nor solve his or her problems. In fact, the tendency of improving personality tends to be, under an appearance of goodness and morality, subordinated to the expression of neurotic content at cross-purposes with such a tendency. These tendencies take most often the form – especially when the paranoid aspects of personality are overwhelming – of marginalisation and persecution of persons and groups where the aggressiveness has been projected. History is full of such tendencies.

world, and the consequent appearance of the new self that answers to the new object' (Mead in Reck, 1964[1913], p. 149).

But how should scientific hypotheses be validated? Here Mead follows – along with William James and the majority of scholars of that period – a positivistic attitude, according to which only quantifiable phenomena can be scientifically tested. This appears clearly in the following passage,

'There is certainly no fundamental distinction between the researches of the historian, the philologist, the social statistician and those of biologist, the geologist and even the physicist or chemist, in point of method. Each is approaching problems that must be solved, and to be solved must be presented in the form of carefully gathered data' (Mead 'The Teaching of Science in College' in Reck, 1964, p. 61).

As noted before, quantitative data are important and should be obtained wherever possible. Moreover, quantitative data constitute only an aspect of, in general, much more complex phenomena, where the qualitative (and most often unmeasurable) aspects of phenomena are equally relevant. Hence, relying only on measurable phenomena is particularly inadequate for the social sciences, and stridently runs counter to the richness of Mead's humanistic approach.

For instance, just a few pages after the above remarks, he laments in university courses the excessive specialisation and the loss of a holistic perspective. In this regard, he notes,

'That unity of social sciences which is given in subject-matter and in human nature itself... is absent from modern sciences... the interconnections are not apparent to the students who are in the special groups... through the history of science, especially of the other sciences which they [the students] do not specialise in, through lecture courses which give them the results of these other sciences they should be able to get the unity of Weltanschauung, which is requisite for any college course' (Mead in Reck, 1964, p. 72).

In order to realise all this, not a positivistic, but a true humanistic approach, giving due weight also to the qualitative aspects of phenomena, is required. Since the qualitative sphere is tied to the issue of social valuing (see also later), this broader approach would demand more scientific pluralism.

Implications for Social Reforms

The foregoing concepts were applied by Mead to a number of social issues with the objective of reforming the most problematic aspects. We will provide some significant examples. In 'The Philosophical Basis of Ethics' he observes that it is useless to apply to individual and social objectives an abstract canon of morality. This comes about because the person and the environment are not independent of each other, but co-evolve in a reciprocal influence. Hence, moral action is effective when it succeeds in embodying and mediating different values and interests. This implies not an uncritical adherence to moral rules, but a creative process of reconstruction of the persons and their environment.

When there is a severance in social relations, social conflicts and alienation will follow. These problems become particularly acute in industrial and commercial relations.

Especially in these realms,

'The individual is treated as if he were quite separable from his environment; and still more is the environment conceived as if it were quite independent of the individual. Both labourer and the society which employs him are exhorted to recognise their obligations to each other, while each continues to operate within its own narrow radius... [for this reason]... it is the incompleteness with which the different social interests are present that is responsible for the inadequacy of social judgement. If the community educated and housed its members properly...the problems at present vexing the industrial world would largely disappear... [hence]... if the social activities involved in the conception of the standard of life were given full expression, the wage question would be nearly answered' (Mead, 'The Philosophical Basis of Ethics' in Reck, 1964[1908] p. 89).

The relevance of this perspective lies in the circumstance that appraises social and psychological analysis as two prongs of the process of social valuation. When such valuation is effective, this means that the person is able to acquire the role of others. And this implies, not only a better social valuation, but a sounder psychological condition coming from an improved capacity to be in an empathic relation with others. If instead social valuation is defective, this indicates, not only the inability of a person to get into the role of others, but a more alienated psychological condition resulting from the lack of empathy.

By employing this framework, many social and political issues can be addressed. For instance, in property rights, one can be tempted to say, in an individualistic way, 'this car is mine and I do not care about the world'. However, this statement would betray at the same time: **(i)** an incapacity to assess the effects of such property rights in the social sphere (for instance in the form of pollution and/or traffic congestion); **(ii)** a parallel incapacity to realise the social foundation of property, in the sense that it has been created and maintained by a well-defined legal and institutional framework; and **(iii)** a mental condition of alienation (or neurosis in psychoanalytic terms) stemming from lack of social empathy.

This incapacity of social empathy is at root of many social evils. For instance, Mead notes, there can be persons who would risk their lives to save other persons in danger, but that nonetheless would consider⁴ it 'normal or inevitable' the deaths linked to bad road conditions and lack of medical aid for the poor.

These aspects are addressed from a different angle in the article 'Natural Rights and the Theory of Political Institution'. Here he underscores the necessity for the system of natural rights – as set forth in the 17th and 18th centuries in Europe – to go beyond an abstract formulation in order to reach out to the living society.

By anticipating several insights of the theories of complexity and open society, he notes that the legal and institutional framework alone is not sufficient to really guarantee its ideal of social justice. In this sense,

'Human rights are never in such danger as when their only defenders are political institutions and their officers... [in fact]... every right that comes up for protection by our courts or other constitutional institution is confessedly in a form which is incomplete and inadequate, because it represents a social

⁴ A typical perception in this respect, most often linked to economic liberalism, is that the state 'cannot afford' the related public spending. An alternative view is contained, among others, in *The Affluent Society* of John Kenneth Galbraith.

situation which is incomplete and inadequate' (Mead, 'Natural Rights and the Theory of Political Institution', in Reck 1964[1914], p. 169).

Of course, this is not to overlook the role of institutions in fostering social progress, but to remember that in the end 'the ultimate guarantee must be found in the reaction of men and women to a human situation so fully presented that their whole natures respond' (Mead, in Reck 1964[1914], p. 170). In order to promote among persons a better awareness of social problems, measures oriented to improve empathy and participation are paramount.

This perspective finds an interesting application in the article 'The Psychology of Punitive Justice'. In this instance, notes Mead, the tendency of law and society is to adopt a criterion of retributive justice and of permanent stigma on the criminal. This attitude, however, not only does not help to solve problems, but rather contributes to creating a criminal class as a structural counterpart – a kind of social *alter ego* – of the legal foundations of society.

The reason for the inadequacy of a concept of retributive justice rests on a negative definition of rights. In this respect,

'Abstract individualism and a negative conception of liberty in terms of freedom from restraints become the working ideas in the community....Thus we see society almost helpless in the grip of hostile attitude it has taken toward those who break its laws and contravene its institutions. Hostility toward the lawbreaker inevitably brings with it the attitudes of retribution, repression, and exclusion. These provide no principle for the eradication of crime, for returning the delinquent to normal social relations, nor for stating the transgressed rights and institutions in terms of their positive social functions' (Mead, 'The Psychology of Punitive Justice' [1917-1918], in Reck, 1964, pp. 226-227).

In particular, what happens in these instances is that – in a typical psychological mechanism of group members projecting their aggressiveness on to a common enemy – all the problems and contradictions of our society are negated and projected on the criminals.

Conversely a better awareness of these problems would constitute a first step for their solution. In his words,

'The discovery that tuberculosis, alcoholism, unemployment, school retardation, adolescent delinquency, among other social evils, reach their higher percentages in the same areas not only awakens the interest we have in combating each of these evils, but creates a definite object, that of human misery, which focuses endeavor and builds up a concrete object of human welfare which is a complex of values' (Mead in Reck, 1964[1917], p. 234).

The issue of transforming the hostility of the offenders and of society towards them into more constructive behaviour becomes a general objective, reaching out to many domains of societal functioning. The problem lies in transforming a primitive and destructive aggressiveness, aimed at annihilating 'the enemy', into a constructive one directed towards problem-solving. For instance,

'The energy that expressed itself in burning witches as the causes of plagues expends itself at present in medical research and sanitary regulations and may still be called a fight with disease. In all these changes the interest shifts

from the enemy to the reconstruction of social conditions' (Mead in Reck, 1964[1917], p. 239).

This perspective is complemented in the article 'Philanthropy from the Point of View of Ethics'. Here the author notes that philanthropic actions tend to fill a gap between reality and an ideal world – or between 'what is and what ought to be' in the terminology of social value theory (see also later). Philanthropic action, then, always implies a process of social valuation which, however, can be more or less explicit. Thus, the task for social reformers is to render explicit these valuations, with a view to transforming them into precise objectives of policy action. These would constitute, in Mead's perspective, true realisation of the democratic ideal. This means the removal of class and group restrictions on the social and cultural values, so that everybody can have the possibility to really enjoy them.

2. The Psychological Contributions of Original Institutional Economics

In this section we will consider the perspective of original institutional economics, with particular attention to some relevant psychological contributions and their implications for the notion of social valuing. We also briefly consider the psychological contributions of John Maynard Keynes.

2.1 The Institutional Economics' Perspective

Institutional economics originated in the United States in the first decades of the 20th century. Its cultural roots can be identified in the philosophy and psychology of Pragmatism⁵ – in particular in the theories of Charles Sanders Peirce, John Dewey and William James – and in the German historical school. The principal founders of institutional economics are Thorstein Veblen, John Rogers Commons, Walton Hale Hamilton, Wesley Mitchell and Clarence Ayres. Within this ambit, three main strands can be identified:

(I) An approach first expounded by Thorstein Veblen, stressing the dichotomy between ceremonial and instrumental institutions;⁶ the role of habits of thought and action; the

⁵ It is important to note that in their heyday pragmatist and institutionalist theories were different both within and between themselves. Moreover, these emerging theories underwent a complex and not always 'linear' evolution, characterised by shifts, at times, towards a behaviouristic (and positivistic) conception of psychology, according to which only observable and measurable phenomena are amenable to truly scientific investigation (see, in particular, Hodgson 2004). However, along these aspects, there were various links and convergences between these theories, whose roots can be found in a cultural climate – such as that informing a significant part of the scientific and intellectual life in the US in the first decades of the 20th century – favourable to progressive social reforms. Another relevant commonality relates to the circumstance that all these theories were elaborated, not on the basis of metaphysical 'first principles', but through the study of real actions in real economies.

⁶ Such dichotomy is related to the distinction between industrial and pecuniary employments, where the former are related to serviceability and latter to the profit motive. In his words, 'The characteristics in which these business employments resemble one another... is that they are concerned primarily with exchange or market value and with purchase and sale... These activities begin and end within what may broadly be called 'the higgling of the market'. Of the industrial employments, in the stricter sense, it may be said, on the other hand, that they begin and end outside the higgling of the market... Broadly, they may be said to be primarily occupied with the phenomena of material serviceability, rather than of exchange value' 'Industrial and Pecuniary Employments' in *The Place of Science in Modern Civilization* (1990[1919], pp. 293, 294). Veblen's ideas on the relations between the quest for profit, conspicuous consumption and ceremonial institutions is vividly expressed in the following passage, 'The quest for profit leads to a predatory national policy. The resulting large fortunes call for a massive government apparatus to secure the accumulations, on the one hand, and for large and conspicuous opportunities to spend the resulting income, on the other hand; which means a militant, coercive home administration and something in the way of an imperial court life – a dynastic fountain of honor and a courtly bureau of ceremonial amenities' in *The Theory of Business Enterprise* (2012[1904], p. 398).

cumulative character of technology in its relations with the workmanship and parental bent propensities; the role of the business enterprise in the modern economy and its effects on business cycles.

(II) An approach initiated by John Rogers Commons, which focuses attention on the evolutionary relations between the economy, law and institutions; the nature of transactions, institutions and collective action, also in their relations to business cycles; the role of conflicts of interest and the social valuing associated with such conflicts; the nature and evolution of ownership, from a material notion of possession, to one of relations, duties and opportunities; the role of negotiational psychology in understanding economic and social phenomena.

(III) An approach developed by Walton Hale Hamilton, Wesley Clair Mitchell and other scholars, dealing with 'market imperfections' at micro and macro levels and their effects on economic systems. The aspects more widely investigated are: market power; the duplication of firms and the inefficiency of many industrial sectors; the insufficient capacity to consume of middle-low income classes; the dynamics of business cycles.

Despite several differences between these approaches,⁷ the elements of convergence are remarkable. For instance, between the concepts of ceremonial and instrumental institutions, on the one side, and the process of social valuing, on the other. In this sense, the observed differences tend to concern more the issues addressed than the basic aspects of OIE. The leading ideas of the institutional economists appear to be the following: **(i)** a belief in the complex and interactive character of 'human nature', and the consequent importance of the social and institutional framework for its amelioration; **(ii)** a refusal to engage in abstract and deductive theorising, detached from the observation of reality, and, as a consequence, an emphasis on inductive methodology based on case studies and statistical analysis; **(iii)** the importance attributed to the notion of 'social control', by which was meant a proactive role for institutions and policies in addressing economic and social problems; **(iv)** an interdisciplinary orientation in order to acquire a more realistic account of the characteristics of human nature in its individual and social unfolding.

This new wave had its seats in various important universities – in particular, Amherst, Chicago, Columbia, Wisconsin – which became the springboard,⁸ through their institutional economists, of important collaborations with numerous research institutions and governmental bodies. The general sentiment pervading these initiatives – and, more generally, the social science environment in that period – was one of optimism about the possibilities of social progress. There were in the OIE's heyday⁹ several contributions that employed (and even created) psychological concepts for explaining economic behaviour. Such a process was strengthened by the parallel developments in the psychology and philosophy of Pragmatism, and in social psychology.¹⁰ In the next paragraphs we will address in more detail two significant contributions¹¹ for our theme, Veblen's Theory of Instincts and

⁷ It is also important to note that, as stressed by various authors (for instance, Yonay, 1998), for a number of reasons neoclassical economics and OIE were in the early 20th century much closer than today. However, even in that period, the overall conception and methodology informing these theories remained different.

⁸ For more details on these aspects refer in particular to Hodgson (2004), Rutherford (2011), Yonay (1998).

⁹ Institutionalism, despite its affirmation in the first decades of the 20th century (until the time of the 'New Deal'), underwent afterwards a marked decline that lasted until the late 1980s. We have addressed this issue in Hermann (2018).

¹⁰ We can mention, among others, the contributions of Ernest W. Burgess, Charles Horton Cooley, Everett Hughes, William F. Ogburn, Carleton H. Parker, William Thomas.

¹¹ As just noted, also other institutionalists provided contributions and/or were aware of the relevance of psychology for the study of economics. For instance, Walton Hale Hamilton (1919), identified for

Commons's Negotiational Psychology.

2.2 Veblen's Theory of Instincts

Veblen, in his book, *The Instinct of Workmanship and the State of the Industrial Arts* (1914), examines the role of two fundamental instincts (or propensities), 'workmanship' and 'parental bent', in economic and social development. Both propensities are intended in a broad sense, 'workmanship' meaning not only technical abilities but the whole of manual and intellectual activities, and 'parental bent' means an inclination to look after the common good that extends beyond the sphere of the family alone.

In Veblen's analysis, these propensities tend, under ideal circumstances, to strengthen one another. This constitutes an important insight confirmed by studies in psychology and psychoanalysis, which stress the need for the person to enhance his or her intellectual, social, and emotional potential through the construction of adequate interpersonal relations.

These propensities are likely to prevail in a situation where other instincts that can act at cross-purposes to them – for instance, predatory instincts which may find expression through a framework of ceremonial and 'acquisitive' institutions based on invidious distinctions – have little social grounds to assert themselves.

Veblen seems to suppose that the first stage of human life was of this kind but that, since then, a number of disturbing factors – mainly related to the affirmation of a 'pecuniary way of life' – have caused a progressive deviation, which was reinforced by a process of cumulative habituation. This idea is conveyed in the following passage,

'The selective control exercised over custom and usage by these instincts of serviceability is neither too close nor too insistent....It appears, then, that so long as the parental solicitude and the sense of workmanship do not lead men to take thought and correct the otherwise unguarded drift of things, the growth of institutions – usage, customs, canons of conduct, principles of right and propriety, the course of cumulative habituation as it goes forward under the driving force of the several instincts native to man,– will commonly run at

institutionalism the following aspects: **(i)** Economic theory should unify economic science; **(ii)** Economic theory should be relevant to the modern problem of control; **(iii)** The proper subject-matter of economics should be institutions; **(iv)** Economic theory is concerned with matters of process; **(v)** Economic theory must be based upon an acceptable theory of human behaviour.

In relation to the latter aspect, he clearly highlights the relevance of social psychology for a more realistic understanding of our behaviour. This is expressed in the following passage, 'The extreme individualism, rationality, and utilitarianism which animated eighteenth century thought still finds expression in neo-classical economics. In its stead a theory of motives must be used which is in harmony with the conclusions of modern social psychology... [neoclassical economics]... assumed that each judgment could be based upon the real facts of the situation and could be made in detachment. It failed to note that my life and yours is a continuous thing, and that what I do today constrains my acts of tomorrow. It overlooked the part that instinct and impulse play in impelling one along the path of his economic activity. And, most important of all, it neglected the influence exercised over conduct by the scheme of institutions under which one lives and must seek his good. Where it fails, institutional economics must strive for success. It must find the roots of activity in instinct, impulse, and other qualities of human nature; it must recognise that economy forbids the satisfaction of all instincts and yields a dignified place to reason; it must discern in the variety of institutional situations impinging upon individuals the chief source of differences in the content of their behaviour; and it must take account of the limitations imposed by past activity upon the flexibility with which one can act in future' (Walton Hale Hamilton, 1919, pp. 316, 317).

cross purposes with serviceability and the sense of workmanship' (Veblen, 1990[1914], pp. 49, 49-50).

This dichotomy lies at the basis of the famous Veblenian distinction between the role of the engineers, acting under the workmanship instinct and therefore directing their actions towards the objective of serviceability, and the role of the capitalists, acting under the influx of propensities at cross-purposes with workmanship, based on acquisitive and aggressive traits, and focused, through the applications of various restrictions on production, on pecuniary gains.

A central element that can strengthen workmanship and parental bent propensities against acquisitive and predatory attitudes rests on the characteristics and intensity of technological progress. In fact, by inducing individuals to adapt themselves to new methods of production, technological progress brings out, through a process of habituation to new habits of thought and life, the workmanship instinct.

As also noted in another work (Hermann, 2015), this view, if not properly qualified, can give rise to a kind of deterministic attitude. In this regard, technological progress is far from being 'neutral' as regards the attainment of social objectives. Therefore, it does not follow a deterministic pattern out of its 'immanent rationality', but it is partly moulded by the characteristics of any given context. In this regard, an increased capacity for analysing social problems – a capacity which can also benefit from progress in the psychological and social sciences – could well be regarded as a genuine expression of the instinct of workmanship which can play a relevant role in social evolution.

2.3 Commons's Theory of Negotiational Psychology

One of Commons's most important insights is that collective action constitutes a necessary element for an adequate performance of individual action. The dialectic and dynamic relations intervening between individual and collective action are effectively expressed in this passage,

'Thus, the ultimate unit of activity, which correlates law, economics and ethics, must contain in itself the three principles of *conflict*, *dependence*, and *order*. This unit is a Transaction. A transaction, with its participants, is the smallest unit of institutional economics... since liberation and expansion for some persons consist in restraint, for their benefit, of other persons, and while the short definition of an institution is collective action in control of individual action, the derived definition is: collective action in restraint, liberation, and expansion of individual action' (Commons, 1990[1934], pp. 58, 73).

Transactions are classified into three categories – Bargaining, Managerial and Rationing – according to the relationship intervening between the parties involved.

The first concerns the relation between individuals with equal rights – which does not necessarily correspond to equal economic power – for instance, between buyer and seller. The second regards the relations between people organised within an institution, for instance between a manager and his or her collaborators. And the third refers to the relations between the person and a kind of collective action where there is less direct involvement. This happens, in particular, with the policy actions of Government and Parliament, but also with the collective action of the most important economic and social associations of society (for instance, political parties, unions, consumers associations).

In order to cast a better light on these manifold phenomena, he elaborated the concept of *negotiation psychology*, aimed at interpreting the conflicts of collective action as expressed through the complex web of transactions and institutions. In his words,

'If it be considered that, after all, it is the individual who is important, then the individual with whom we are dealing is the Institutionalised Mind. Individuals begin as babies... They meet each other, not as physiological bodies moved by glands, nor as "globules of desire" moved by pain and pleasure, similar to the forces of biological and animal nature, but as prepared more or less by habit, induced by the pressure of custom, to engage in those highly artificial transactions created by the collective human will... Every choice, on analysis, turns out to be a three-dimensional act, which – as may be observed in the issues brought out in disputes – is at one and the same time, a performance, an avoidance, and a forbearance... The psychology of transactions is the social psychology of negotiations and the transfers of ownership... Thus each endeavors to change the dimensions of the economic values to be transferred... This negotiation psychology takes three forms according to the three kinds of transactions: the psychology of persuasion, coercion, or duress in bargaining transactions; the psychology of command and obedience in managerial transactions; and the psychology of pleading and argument in rationing transactions... Negotiation psychology is strictly a psychology of ideas, meanings, and customary units of measurement' (Commons, 1990[1934], pp. 73-74, 88, 91, 106).

On that account, we can note that, while it is certainly true that Commons's negotiation psychology originates from his institutional role of arbitrator, it is also true that his vision is inscribed in a more far-reaching social ontology. This perspective rests (in particular, Commons, 1990[1934], Vol. I, Chapter II) on the pragmatist approach,¹² on philosophers like David Hume and John Locke, and on Gestalt psychology. On that account, he clarifies that,

'Negotiation psychology approaches more nearly to the "Gestalt" psychology which, however, is distinctly an individualistic psychology... the resemblance consists in the fact that Gestalt psychology is a part-whole psychology, wherein each particular act is connected with the whole configuration of all acts of the individual' (Commons, 1990[1934], p. 106).

¹² In this regard, Commons provides interesting remarks on the meanings of pragmatism and their relation with institutionalism, '[in the discussion of pragmatism] we are compelled, therefore, to distinguish and use two meanings of pragmatism: Peirce's of purely a method of scientific investigation, derived by him from the physical sciences but applicable also to economic transactions and concerns; and the meaning of various social-philosophies assumed by the parties themselves who participate in these transactions. We therefore, under the latter meaning, follow most closely the pragmatism of Dewey; while in our method of investigation we follow the pragmatism of Peirce. One is scientific pragmatism – a method of investigation – the other is the pragmatism of human beings – the subject-matter of the science of economics... Not until we reach John Dewey do we find Peirce expanded to ethics, and not until we reach institutional economics do we find it expanded to transactions, going concerns, and reasonable value' (Commons 1990[1934], pp. 150-151, 155). Shortly afterwards, Commons makes other interesting remarks on the reason why he developed his negotiation psychology, 'Something similar is the test in economic science, as Peirce found in physical science. But the essential difference is that physical science deals with knowledge of activities within the body of cosmos, including human beings as nature's objects; while the economics deals with the individual as a citizen endowed with rights, duties, liberties, and exposures, in varying degrees imposed by various concerns. It is this distinction that requires a negotiation psychology, different from historic psychologies and different even from what is currently known as social psychology' (*ibidem*, p. 157).

Within this context, the concept of reasonable value¹³ is employed by Commons in order to draw attention to the conflicting, imperfect and evolutionary nature of the process of social value. This is set forth in the following passages,

'The preceding sections of this book brought us to the problems of Public Policy and Social Utility. These are the same as the problems of Reasonable Value and Due Process of Law. The problem arises out of the three principles underlying all transactions: conflict, dependence and order. Each economic transaction is a process of joint valuation by participants, wherein each is moved by diversity of interests, by dependence upon the others, and by the working rules which, for the time being, require conformity of transactions to collective action. Hence, reasonable values are reasonable transactions, reasonable practices, and social utility, equivalent to public purpose....Reasonable Value is the evolutionary collective determination of what is reasonable in view of all changing political, moral, and economic circumstances and the personalities that arise therefrom to the Supreme bench' (Commons, 1990[1934], pp. 681, 683-684).

Reasonable value is, by definition, an imperfect process, whose characteristics can be interpreted as the synthesis of the conflicting and evolutionary components of collective action. The imperfection of social valuing stems also from its partly unconscious and conflicting character, often embodied in habits of thought and life. In this sense, social value process goes to the heart of the nature of political economy, which is considered, not an activity stemming from the application of abstract laws, but as a collective and evolutionary decision-making process involving many institutions. In this sense, political economy has a close relation with law and ethics,

'If the subject-matter of political economy is not individuals and nature's forces, but is human beings getting their living out of each other by mutual transfers of property rights, then it is to law and ethics that we look for the critical turning points of this human activity' (Commons, 1990[1934], p. 57).

Other Contributions of Heterodox Economics

The previous theories do not exhaust the spectrum of psychological contributions provided by heterodox fields of economics.

Another interesting employment of a psychological perspective can be found in John Maynard Keynes. He was well acquainted with psychoanalysis, and introduced into the *General Theory* (1936) the central notion of 'animal spirits', whereby people engage in economic and social activities, not only out of strictly economic calculation, but also out of a propensity to do something, to keep themselves engaged in social life.

¹³ An interesting definition of the concept of social valuing is the following 'To conceive of a problem requires the perception of a difference between 'what is going on' and 'what ought to go on'. Social value theory is logically and inescapably required to distinguish what ought to be from what is....The role of social value theory is to provide analyses of criteria in terms of which such choices are made' (M. Tool, in Hodgson, Samuels & Tool, 1994, pp. 406, 407). This is linked to the 'instrumental value criterion' which pertains to the goal of 'the continuity of human life and the non-invidious re-creation of community through the instrumental use of knowledge' (Tool, 1986, p. 50).

This notion goes in tandem with his analysis – set forth in *Essays in Persuasion* (1931) – of the long-term transformation of the system. These changes, by increasing the productivity of labour, will open the way for a society of ‘free time’. In this regard, Keynes notes, with a notable psychoanalytic insight, that the main obstacle to this transformation is not technical but psychological. In his words,

‘We are being afflicted with a new disease of which some readers may not yet have heard the name, but of which they will hear a great deal in the years to come—namely, *technological unemployment*. This means unemployment due to our discovery of means of economising the use of labour outrunning the pace at which we can find new uses for labour....But this is only a temporary stage of maladjustment. All this means in the long run *that mankind is solving its economic problem*....[but, despite this opportunity]....Yet there is no country and no people, I think, who can look forward to the age of leisure and of abundance without a dread. For we have been trained too long to strive and not to enjoy....[hence, in this perspective, economics]....should be a matter for specialists—like dentistry. If economists could manage to get themselves thought of as humble, competent people, on a level with dentists, that would be splendid!’ (Keynes 1963[1931], pp. 364, 368, 373).

Conclusions

As emerged from the previous account, the psychological perspectives of pragmatism and institutionalism undoubtedly constitute the most elaborate body of social psychology of the time, which has exerted a significant influence up to our time. As noted before, these theories are different both within and between themselves, but also present notable complementarities. Starting with pragmatist psychology, we can recall its attempt to provide a well grounded ontological perspective to the study of persons in their individual and collective actions.

In a sense, pragmatist psychology is chiefly an extension of the main principles of pragmatist philosophy to sphere of psychological life. However, there are also notable differences between the theories addressed before. In fact, James’s approach is definitely more individualistic than Mead’s. The latter’s perspective is explicitly focused on the analysis of social self and the role of social reform in its improvement.

Despite their differences, James’s and Mead’s theories are complementary in many respects. For instance, there can be a useful synergy between James’s notions of habits, instincts and will, and Mead’s theory of the social self as the integration of various social roles.

The same can be said for Commons’s and Veblen’s psychological theories. In fact, along with various differences, their theories present also notable complementarities. For instance, Commons’s negotiational psychology can help locate the Veblenian dichotomy between instrumental and acquisitive propensities in the various transactions (and their interrelations) wherein persons and institutions are engaged. For instance, it is likely that these propensities would find a different expression according to the role of persons and institutions in society. In this sense, along with common aspects, there are distinct ‘psychologies’ for ‘white’ and ‘blue’ collar workers, freelancers, well established professionals, entrepreneurs, capitalists, public officials and politicians.

These ‘psychologies’, in turn, are co-extensive with the nature and evolutions of

economic systems (and in particular, with the complexity of the 'mixed economies' of our time).

Similar remarks can be made for the links between pragmatism and institutionalism. As noted before, these theories, along with several differences, also share a common ground whose roots can be found in a cultural climate favourable to the study of real economies and to the realisation of progressive social reforms. The most important implication of this analysis pertains to the necessity of overcoming the fragmentation (or limited collaboration), so often present in social and psychological sciences. As observed by the famous sociologist Karl Mannheim, a landscape can be seen only from a determined perspective, and without perspective there is no landscape. In this sense, observing a landscape (or phenomenon) from different angles (or disciplines) can help us to acquire a much clearer insight into the features of the various perspectives.

Some Implications for Policy Action

In this respect, the psychological concepts elaborated by institutionalist and pragmatist authors, also in collaboration¹⁴ with social psychology and psychoanalysis, can lead to a better understanding of the features and evolution of social valuing in any given context, which finds expression in the complex tangle of motivations, conflicts, and expectations, both at an individual and collective level. An improved process of social valuation, in turn, will improve the capacity of policy action to understand and respond to the profound needs of society. The stress put by many institutional economists on policy action brings to the fore the issue of economic planning. On that account, OIE (see, in particular, Dugger, 1988; Tool, 1986; 1988), identifies three kinds of economic planning: corporate, totalitarian, and democratic. Corporate planning is the reality of modern capitalism. In this system, the operation of 'free market forces' is heavily conditioned by the interests of big corporations.

¹⁴ For an analysis of some important psychological and psychoanalytic contributions to the study of social sciences refer, among others, to S. Freud (1912-1913, 1921, 1930), Ammon (1971), Bion (1970), Desjarlais and others (1995), Fenichel (1945), Horney (1939), Kahneman and Tversky (2000), Kernberg (1998), M. Klein, Heimann and Money-Kyrle (1955), Nisbett e Ross (1980), Ross and Nisbett (1991), Sullivan (1953).

These studies underscore in various ways the role of groups and organisations in expressing the needs and conflicts of the person. For instance, to the person, the group may represent an idealised *ego*; and, in this connection, its 'morals' and 'code of conduct' symbolise parental figures that, through a process of 'internalisation', play the role of *superego*.

In this respect, the concept of the *superego* represents the psychological instance through which cultural values are internalised by the child. For this reason, it constitutes a fundamental link between individual and collective psychology. In this light, and contrary to a rather common view that considers psychoanalysis an individual psychology, it can be interesting to note that Sigmund Freud considers individual and collective psychology as two complementary aspects of the same phenomenon – owing to the circumstance, stressed in particular in his *Group Psychology and the Analysis of the Ego*, that in ancient times, group life was preponderant and that only subsequently has the person gradually come to assume a more distinct role within the various groups of society.

Hence, psychoanalysis can cast light on the psychological conflicts that, while arising in the early emotional life of the child in the family setting, will bear on its future socio-economic relations.

In such enquiry, psychoanalytic concepts can usefully complement with the concepts of pragmatist and OIE psychology. For instance, in the analysis of the effects of psychological conflicts on (i) the formation of the 'social self' and the related process of internalising the attitude of others (and hence in the formation of individual and social identity); (ii) in the shaping of the various propensities of the persons.

All this would allow a more far-reaching analysis of the motivations and conflicts underlying the various spheres of economic action – work, consumption, investment, saving – related to persons, groups, classes and how they impinge on the evolution of the system. For instance, does the *homo oeconomicus* maximise money only for 'material reasons'? Or does the quest for money also cover (in a partly unconscious and conflicting way) the need to be accepted by following a socially approved behaviour? An analysis of this kind is interesting not only *per se*, but also because such understanding can improve the effectiveness of policy action (some more remarks in the next footnote).

They possess a wide array of instruments to influence the structure of all the relevant markets in which are engaged. In Dugger's words,

'The corporation is privately efficient in its pursuit, but it is not socially efficient because its low-cost, high-productivity performance benefit those who control it, generally at the expense of those who depend upon it but frequently also at the expense of the society at large' (Dugger, 1988, p. 239).

Corporate planning is highly hierarchical, since the key decisions are taken by the top managers with little involvement of workers and citizens at large.

Totalitarian planning is a system characterised by a public purpose, which is pursued through a highly hierarchical structure. Such organisations – though they may have sometimes achieved important results in building infrastructure and poverty alleviation – are flawed due to a fundamental lack of accountability and democratic representation. This system, then, by acquiring a marked self-referential character, makes impossible any objective and pluralistic assessment of the policies adopted and the results achieved.

We switch then to the third alternative, democratic planning. This system, although it does not always work miracles, is definitely more promising. In fact, one central difference of democratic planning with respect to corporate and totalitarian systems resides in a better capacity to self-correct – by a process of trial and error – its own shortcomings. Of course, the unfolding of such potential crucially depends on the effectiveness of social valuing¹⁵ related to different policy options. In this perspective, democratic planning can find application in the reality of concerted or regulated capitalism as a powerful way to address the major economic imbalances of our time (and in this way was intended by their chief proponents). In this light, a

¹⁵ A central step in such process relates to getting a better look at the manifold aspects of our habits of thought as stressed by the pragmatist and institutionalist authors. They shed light on the following aspects of habits: (i) to economise mental energies; (ii) to internalise norms of behaviour; (iii) to adapt to the circumstances of life.

These authors were well aware that habits often embody 'non rational' aspects (in the sense that they are more based on socially shared patterns of action than on a clear analysis of the pros and cons). For this reason, these scholars set, somewhat implicitly, as one goal of their enquiry, the attainment of a better awareness of the inner meaning of our habits of thoughts and life.

On that account, a better social valuation process, by facilitating a thorough comparison between different policy options, most often rooted in entrenched habits of thought, constitutes a crucial step in building more informed policy actions.

Such a process, in turn, can benefit from the employment of the concepts addressed in this work. As a case in point, let us recall Mead's example of persons who would risk their lives to save other persons in danger but that nonetheless would consider 'normal or inevitable' the deaths linked to bad road conditions (or the lack of aid for disadvantaged people). Such habits of thought are most often linked to the neoliberal idea that the state 'cannot afford' the related public spending. In this respect, we can wonder how realistic such a perception is and what is the role of psychological factors in its shaping. For instance, what is the role of *superego* – as a kind of defensive and punitive instance against our aggressive and greedy fantasies – in creating in our mind a notion of 'artificial scarcity'?

An important distinction between natural and artificial scarcity was drawn by Commons. In his words, 'Natural selection, which is the natural survival of the "fit", produces wolves, snakes, poisons, destructive microbes; but artificial selection converts wolves into dogs, nature's poisons into medicines, eliminates wicked microbes, and multiplies the good microbes... here the survival is the "artificial selection" [driven by the social valuation related to different cultural and policy orientations] of good customs and punishment of bad customs, and it is this artificiality, which is merely the human will in action, that converts mechanisms into machines, living organisms into institutionalised minds, and unorganised custom or habit into orderly transactions and going concerns' (Commons, 1990[1934], pp. 636, 638).

These concepts were also expounded by John Kenneth Galbraith's *The Affluent Society*, which has interesting parallels with the OIE's perspective. The closing sentences of this book well synthesise these aspects, 'To furnish a barren room is one thing. To continue to crowd in furniture until the foundation buckles is quite another. To have failed to solve the problem of producing goods would have been to continue man in his oldest and most grievous misfortune. But to fail to see that we have solved it, and to fail to proceed thence to the next tasks, would be fully as tragic' (Galbraith, 1998[1958], p. 260).

wide array of contemporary issues, most often involving a supranational dimension, can be addressed. These include the building of peaceful relations, the reduction of gross inequalities between persons and economic areas, and, as a pivotal theme traversing the previous issues, the solution of environmental problems.

Acknowledgements

I wish to thank Geoffrey M. Hodgson, John Dennis Chasse, the Journal's editors and Kyla Rushman for their useful comments. The usual disclaimer applies.

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SUGGESTED CITATION:

Hermann, Arturo (2020) 'The Psychological Contributions of Pragmatism and of Original Institutional Economics and their Implications for Policy Action.' *Economic Thought*, 9.1, pp. 48-71.

<http://www.worldeconomicssociation.org/files/journals/economicthought/WEA-ET-9-1-Hermann.pdf>

Mathematical Analysis as a Source of Mainstream Economic Ideology¹

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Abstract

The paper contends that neoclassical ideology stems, to a great extent, from mathematical analysis. It is suggested that mainstream economic thought can be comprehensively revisited if both histories of mathematical and economic thought are to be taken collaboratively into account. Ideology is understood as a 'social construction of reality' that prevents us from evaluating our own standpoint, and impedes us from realising our value judgments as well as our theories of society and nature. However, the mid-19th century's intellectual controversies about the validity of mathematical thought, truth and knowledge can procure new interesting insights concerning the ideological stance of the first marginalists. In this respect, the methodological categories of analysis and synthesis serve as the basis for the crucial distinction between *old* geometry and mathematical analysis, indicating that the discipline of mathematics has its own history of fundamentally unresolved disputes. Lastly, this may also shed some light on Alfred Marshall's peculiarly reluctant attitude towards the use of mathematical analysis in his work.

Keywords: mathematical analysis, synthesis, neoclassical theory, Marshall

1. Introduction

The evolution of mathematical ideas, similarly to economic ones, adheres to a rather impressive and thought-provoking history that could rub our old dusty soil with fresh water. The present paper aims to show that economic practitioners, after recognising that

'the mechanical way in which [differential] calculus sometimes is taught fails to present the subject as the outcome of a dramatic intellectual struggle which has lasted twenty-five hundred years [...] and which will continue as long as man strives to understand himself as well as nature' (Courant, foreword in Boyer, 1949, p. i)

might feel the need to revisit aspects of their own established knowledge. In accordance, the paper intends to contribute toward the research lines that have already been set forth by Weintraub (2002), whose pivotal work concerning the relation between economics and mathematics take the histories of thought of both disciplines into consideration. What is more, the important points raised by Dow (2003) are also highly valued, especially the one referring to 'the history of the development of mathematics and its relations with economics' (Dow, 2003, p. 547). Looking into this stimulating field proves refreshing and renders new interesting

¹ This research is co-financed by Greece and the European Union (European Social Fund-ESF) through the Operational Programme 'Human Resources Development, Education and Lifelong Learning' in the context of the project 'Reinforcement of Postdoctoral Researchers-2nd Cycle' (MIS-5033021), implemented by the State Scholarships Foundation (IKY).

insights of the mid-19th century theoretical developments, which have culminated in the writings of highly esteemed economists such as Cournot, Gossen, the first marginalists and Marshall. Mainstream economic ideology can be fairly reevaluated through the ontological controversy that took place within the branch of natural philosophy, a blend of what is today broadly known as classical physics *and* mathematics.

The argument below emanates from the idea that the history of Political Economy should begin to incorporate and, if necessary, revise several aspects of the historical development of mathematical thought into its own curriculum, so that the obscured ideological views underlying the various conceptions, can come to the fore. Investigating the social content of mathematical ideas would provide evidence that a clear cut dichotomy between natural and social sciences is not that definite – to the degree, at least, that it is currently believed to be.² Nature does not speak for itself, neither does its heart open to us widely to reveal the laws under which it is governed. The modes of reasoning that we use towards understanding nature, encompass parallels and coherent views of society. In this respect, ideology, the imposed array of prejudices which limits the scope of any research, no matter how thoroughly undertaken, veils the spectrum of our vision, blinds our judgment or, under particular circumstances, turns into a deeper understanding of phenomena and reflects upon the ‘impartiality’ of our point of view. However, if one ‘seeks to understand and allow for these prejudices (and he is certainly morally obliged to do so) then he must examine his whole individual and social history and background’ (Macfie, 1963, p. 225). That being so, careful and laborious contemplation requires considerable effort in tracing the roots of the so-called ‘historical puzzle’ with regard to the ‘attachment of almost every economist [...] to the mechanistic dogma’ (Georgescu-Roegen, 1971, p. 2).

As already mentioned, this standpoint is not new to our field. Reputable scholars have undertaken the painstaking task of bringing together the histories of these two apparently distinct areas. Among the most prominent studies, the comprehensive work of Phillip Mirowski (1989) has attracted a lot of attention due to its unique manner of inspecting the subject. Mirowski maintains that the dominion of neoclassical economics is, to a large extent, owed to the fact that it arose as an immediate fruit of mathematical physics’ 1870s rigorousness. His historical method of research is carried out by tracing the gradual application of the mechanistic techniques into this branch of Political Economy and by encountering the analogies between the several concepts of the two fields, such as that of ‘utility’ and that of ‘energy’. In another fashion, Weintraub (1991) examines the history of static and dynamic versions of equilibrium theories following the 1930s, focusing on the multiplicity of ways economic scholars have interpreted it. In that study, equilibrium is captured as a central feature of economic theorising that lacks empirical justification, while being part of an arcane language used among the field’s associates. This neo-platonic³ or constructivist view of economic knowledge has been criticised on the grounds that it fails to recognise the ‘definite assertions about the nature of reality’ (Blaug, 2003, p. 152) it involves and the political statements it implies.

² Theocarakis (2014) has traced the origins of this distinction to be at least as old as the *Dialogue* of Galileo Galilei (1632). ‘If what we are discussing were a point of law or of the humanities, in which neither true nor false exists, one might trust in subtlety of mind and readiness of tongue and in the greater experience of the writers, and expect him who excelled in those things to make his reasoning most plausible [...] But in the natural sciences whose conclusions are true and necessary and have nothing to do with human will, one must take care not to place oneself in the defense of error’ (Galileo Galilei, 1632, pp. 53-54).

³ The neo-platonic approach considers mathematical ideas as having no necessary foothold within our surrounding physical universe. ‘Mathematical reasoning was seen as a mental art rather than a physical one with [...] empirical unverifiability of a theoretical process’ (Whiteside, 1961, p. 185). By the late 18th and early 19th century however, this view had been abandoned. The Scottish mathematician John Leslie was contented that ‘Geometry is [...] founded on external observation’ (Leslie, 1811, p. 1).

The primary reason why both histories of thought require a combined effort in further examination is related to the paper's main aim, showing that mainstream economic thought has been ideologically influenced by a specific branch of mathematics – that of *analysis*. Be that as it may, a survey on ideology falls out of scope of this paper. Ideology is here treated in a narrow sense and as a meaningful term to help us bring forward the intense relation between mathematical analysis and neoclassical thought. In that respect, the manner in which 'social constructions of reality' (Berger and Luckmann, 1966) are being built is not investigated below. For our purposes, it would suffice to add that ideology is understood as an indispensable part of the theories themselves, with regard to both society and nature, and not just as an exclusive relation between the observer and the observed. It is broadly approached as a feature that characterises the totality of human thought, both scientific and moral.

Ideologies can be conceived as pre-constructed frameworks found upon the sets of beliefs, intending to infuse meaning and values to the latent material mediating social conduct. The representations they offer to natural and social life are themselves partial and to that respect, Heilbroner (1990, p. 103) classifies them under the field of rhetorics i.e. the art of persuasion. Some aspects of the social or natural phenomena are concealed whereas others are magnified. Through this angle, the critique posed by Meek (1967) suggesting that no scientific approach in the field of economics can exempt itself from 'ideological distortions' is in accordance with the main argument below. By 'distortions', Meek does not contend that ideological views deviate from an objective or absolute knowledge of the truth. Distortions refer to frameworks of perception used by economists, emphasising on specific aspects while others are left aside. The mixture of ideology and science, Meek suggests, cannot be sorted out. In what follows below, this thesis is extended in order to maintain that mathematical thought is of ideological essence and its vision of the world has, moreover, influenced the economic perception of society.

In section 2, the ideological aspects of mathematical thought are discussed in relation to Political Economy. Section 3 refers to a rather short part of an extensive debate between the main figures of the Victorian era of natural philosophy, illustrating that the history of mathematical thought is better understood when approached as a controversy of beliefs instead of as an exegesis of proving the truth. It is claimed that algebra does indeed constitute a mode of reasoning and not just a 'perfect system of language, adapted to the notions and relations that we need to express' (Jevons, 1871, p. 5). Objections are not raised against symbols or symbolic treatment, but against the ideas incorporated and the political and social extensions to which they refer. Section 4 traces the seminal idea of analytical thought, while in Section 5, some remarks from the main representatives of the dominant paradigm relating to the subject of mathematical analysis and economics are discussed. In that context, Alfred Marshall is approached as a special case requiring careful treatment.

2. A Politico-mathematical Economy

Recent contributions have examined several aspects of the relation between mathematics and economics. Among them, Milonakis (2017) can be singled out for his emphasis on the role of social and political history in the development of mathematical formalisation of economic ideas. His argument unfolds in the line that classical political economists were more cautious, even reluctant, when expressing their theoretical statements mathematically since, to them, the social and historical qualities that perish when mathematical language is applied, were important elements of their arguments. From a different perspective, Martins (2012) has claimed that mainstream economic theory incorporates a specific trend of mathematical thought, which draws heavily on the Cartesian, algebraic tradition. He goes on to assert that

economists who did care about the realistic conceptualisation of their theories – such as Marshall, Keynes and Sraffa – held a different stance concerning the mathematisation of economics, while their techniques bore close resemblance to that of Newton. What is not pointed out in neither of these approaches, however, is the evaluation of the entrenched ideology, existing in all principles of human thought, mathematics be no exception.

Studies considering the issue of ideology in economic thought, usually place emphasis to Schumpeter's *History of Economic Analysis* (Heilbroner, 1990; Dobb, 1972; Meek, 1967; 1957). Considering our purposes, the need for resorting to the *History* is two-fold. To start with, Schumpeter regards ideology as a qualitative property that can easily be detached from our theoretical insight and secondly, he keeps a strong position in favor of analysis as a practical and unassailable tool of scientific inquiry. '[M]athematical economists' he says, 'form no school in any meaningful sense of the term, any more than do those economists who read Italian' (Schumpeter, 1954, p. 922). Consequently, for Schumpeter, the main instrument of economic thought is held to be unbiased, having no effect on the manner in which the concepts of our discipline are constructed in our minds and theories. Mathematical thought is interpreted as a solid and unified field of uncontroversial character and knowledge, which exclusively corresponds to its analytical trend that, at least in Britain, dominated the subject around the mid-19th century. It would, thus, come to no surprise that in his *History*, Schumpeter concentrates on the 'history of those techniques' which he characterises as 'scientifically admissible'. To succeed in this, he ensures to advise that 'a number of obstacles will have to be removed before we can feel sure of our ground – the most serious one carrying the label *Ideology*' (Schumpeter, 1954, p.6, my emphasis). What still remains in darkness though, is that the very preference preceding the application of analytical techniques in which the ideological features of our vision of economic issues are deemed to be removed, contains a lot of ideology *in and of itself*.

The term 'mathematical economist' used by Schumpeter, has also been endorsed by Samuelson as he who 'need not be of any political persuasion' (Samuelson, 1960, p.25). Here, obviously, Samuelson attempts to detach mathematics from its rhetoric or, to recall Heilbroner, its ideological aspects. Others, have sought for the antecedents of mathematical economists even before the age of Cournot (Robertson, 1951), as if they are non-historical creatures that have always existed, capable of applying the techniques of differential calculus in their work, while, Theocharis (1993), saw the application of mathematical analysis in economic theory as the gradual progress of accumulated knowledge.

Discussion with respect to the relation between ideology and 'mathematical economics', however, has produced a series of counter arguments and competing approaches as that between Lawson (2012) and O'Boyle and McDonough (2017). The former's claim that 'mathematical methods and techniques are essentially tools' (Lawson, 2012, p. 3) deviates substantially from our current view, in which mathematical ideas are recognised as social products fusing life and essence in the rudimentary forms of expression. Next, Lawson, takes up Kline (1964) to stress out that the modern tendency towards formalisation emanates from a well-rooted, culturally wide-spread aesthetic prejudice, which grants mathematical expression with an air of sophistication. The narrative takes no account of the evolution of mathematical ideas in themselves neither of the differentiated views of the world their several trends can offer. William S. Jevons, for example, discerns between a 'true' and a 'false mathematical theory', applying the first one so as to correct the theoretical impasses in which Smith and Ricardo had fallen after following the latter (Jevons, 1862, p.487). As it may be the case, a distinction between mathematical theories has also been acknowledged by O'Boyle and McDonough (2017) when endorsing the concept of 'mainstream mathematics'. One of their main arguments is built on the idea that 'marginalist

mathematics were entirely subservient to an ideological utilitarianism' (O'Boyle and McDonough, 2017, p.26). The authors suggest that the symbolic reasoning that stems of particular social context is value-laden, attempting to reproduce dominant thinking and social relations. As it is indicated below, a particular strand of mathematical thought has infused its own ideology into mainstream economic theory.

Within the mainstream approach, the Political Economy of Adam Smith is commonly understood as gravitating towards the idea of an invisible hand (WN, IV.ii.9). This popular metaphor blends together in a mixture of mystical and logical forces, operating as a compromise that mediates between the counter aims of antagonistic social groups, precipitating the realisation of unintended outcomes (Aydinonat, 2008). Neoclassical economics, in the broad sense of the term, has given significant weight in this allegory and treats it as a short-cut argument in favor of laissez-faire policies bestowed by Smith's authoritative status. Throughout neoclassical analysis, the virtuous ends of individual actions remain secret to them and are revealed only after having been engaged with the attainment of their own private gain. However, opposing social and individual aims are brought forward in a manner consistent with the thought customs of the entire scientific epoch of 18th century, when market outcomes were still questioned on the grounds of their moral qualities. Skinner (2012, p. 163), for example, maintains that Smith was influenced by the pioneering concept of François Quesnay's tableau, in which the economy was contemplated as a system resembling a human body, in which blood flows autonomously through its veins. In this primitive model, 'blood' flows circularly and independently of our personal will, bearing a central implication on the fact that as we cannot claim any authority or subjective judgment upon the proper and healthy function of the body, economy should similarly be given the freedom to operate according to patterns and ideals of natural liberty. Human heart keeps beating irrespective of man's conscious desire to do so. Interestingly though, neoclassical theory, Dobb explains, incorporated an ideal moral form of natural liberty as it was derived from the application of differential calculus techniques.

'[T]he term 'Neo-classicists' is not entirely inappropriate; for what the Cambridge school has done is to divest Classical Political Economy of its more obvious crudities, to sever its connection with the philosophy of natural law, and to restate it in terms of the differential calculus' (Dobb, 1924, p. 68).

August Cournot, the pioneer in applying the method of calculus in Political Economy, had contributed in a rather sophisticated way to give the impression that his mathematical analysis was an objective and unprejudiced judge of knowledge.

'I have not set out to make a complete and dogmatic treatise on Political Economy; I have put aside questions to which mathematical analysis cannot apply' (Cournot, 1838, p. 5)

Dogmatism was recognised as believing in anything but mathematical analysis, which systematically was becoming the tool of separating the wheat from the chaff! The moral status of this technique was spread and became one of the main tools for identifying appropriate and inappropriate interpretations in the years of Alfred Marshall's youth. Marshall seems to be familiar with the practice of using that kind of mathematical prejudice as the touchstone for economic truth⁴, when, in a letter to J. B. Clark, he writes:

⁴ Jevons (1862, p. 488) understands this technique as 'the touchstone which can decide between truth and error'.

'My acquaintance with economics commenced with reading Mill, while I was still earning my living by teaching Mathematics at Cambridge; and translating his doctrines into differential equations as far as they would go; and as a rule, rejecting those which would not go' (in Pigou, 1966, p. 412).

However, as suggested in the citation, during his mature years, Marshall, an astute mathematician, did not share the same enthusiasm with Jevons on the implementation of differential calculus in economic theory. The latter was sought for a 'true theory of Economics' adhering to the 'appropriate branch of mathematical science [...which] consists in applying the differential calculus...' (Jevons, 1871, p. 3), whereas the former contends that 'the argument in the text is never dependent on them [...]. The chief use of mathematics in economic questions seems to be in helping a person to write down quickly, shortly and exactly, some of his thoughts for his own use' (Marshall, 1961, p. xiii). On that account, among the main figures of neoclassical tradition, the views concerning the validity or usefulness of mathematical analysis differ substantially.

Similarly to Jevons, Walras wholeheartedly believed in the practical as well as ethical importance of this 'science of small increments.' His groundbreaking research was concerned with the question of 'how could political economy be simultaneously a natural science and a moral science?' (Walras, 1874, p. 56). In its pure form, Political Economy should blend the 'blind and ineluctable forces of nature' along with 'those which result from the exercise of human will [...] free and cognitive' (Walras, 1874, p. 61). Such a positivistic and ethical project would require a scientific field 'as an explanation of what is and as a programme of what ought to be' (Walras, 1874, p. 60). Moreover, the latter would correspond to an idea of justice secured under the process of free exchange in the market. It was considered legitimate for Political Economy to use the tools applied in natural science, even if its objects of inquiry could not be exactly measured. With reference to these tools, whenever barter takes place in the market

'there are none by which to measure the intensities of needs of traders. But it is of no importance, since each trader takes upon himself this operation, consciously or unconsciously, and decides for himself if these last needs satisfied are proportional to the values of the commodities. Measure, that is, the comparison of quantities and quantitative relations, is not prevented by its exterior or interior quality, according to whether the measurable facts are physical or psychic. Consequently, neither is science denied its mathematical character' (Walras, 1909, p. 213).

Mathematical analysis (and the technique of utility maximisation) was regarded as having the ability to abstract and squeeze out the constitutive juice of a particularly meaningful and complex occasion that could distract the observer's attention. The fairness of the market outcome was thought to be realised through the use of this tool, independently of human will. '[T]his price of wheat does not result either from the will of the buyer or from the will of the seller or from any agreement between the two' (Walras, 1874, p. 69). The magic of the marketplace was up to a point reasonably analysed. How, thus, to justify further the occult forces upon which this outcome was produced? The remaining unexplained part of the final compromise between the opposed individual interests was charged on Smith's invisible hand that, unfortunately, was all that would be left hitherto from his theory to remember.

The marginal school did not arise as an immediate outcome of scientific machinery, but rather as a gradual historical process. A great number of studies, so far, have emphasised

the fruitless projects aiming to transform the body of knowledge of economic theories into a clear-cut positive one, the concepts of which will be directly produced and best interpreted by the toolbox of mathematical analysis. A step backwards, however, may provide us with some vital space to consider that knowledge, whether of natural things or of concepts of pure reason, is neither straightforward nor certain. On the contrary, one may argue about the ethical ground on which it has been instituted. For instance, Werner Stark's (1943) *The ideal foundations of economic thought* can be viewed as an attempt to revisit the knowledge of our discipline through the old-fashioned lenses of its ethical origins. It has been pointed out that Stark appears to be 'hostile to the modern tendency to analyse society in terms familiar to those employed in the realm of Nature. He is hostile alike to capitalism and the emphasis of most contemporary economic thought' (Dobb, 1944, p. 153). This observation is crucial, for it seems to acknowledge the presence of an imperceptible thread linking epistemological and political views. Indeed, the former idea has certainly shaped the research method of the author himself whose investigation of logical and metaphysical problems set forward by Leibniz, led him to suggest that

'behind the formal problem of the relation between the continuum and its points, between whole and parts, lies hidden the material problem of the relation between the universe and its elements, between society and individuals. His sober mathematics contains a deep cosmology and sociology' (Stark, 1943, p. 27).

Stark clearly suggests that one of the major mathematical problems Leibniz was confronted with, wasn't thought out as an issue of mere scientific speculation falling solely within the realm of enlightened reason. In a quite different perspective, the multiplicity of its purpose extended far beyond the intellectual contentment of providing rigorous answers to questions posed by logic, just 'for the glory of human thought' (Moret, 1915, p. 6, in Ingrao and Israel, 1990). As was the case, mathematical reasoning was exercised like an *a priori* instrument of supreme ethical qualities and unquestionable benevolence, able to produce outcomes that were consistent with definite political arguments and, at the same time, reasonably proven. The divine merit of mathematical thought⁵ was portrayed in the belief that it served as a 'link between ourselves and the best and noblest benefactors of our species' (Herschel, 1830, p. 16). As a precondition, in case a mathematical solution was offered to a problem of any kind, whether of political, social or natural essence, that solution and every logical extension with which it was associated had to, consequently, be of undoubted ethical status. Hence, the mathematical ideal of a society without tensions, class struggles and social disputes, was envisaged as a concomitant result of accepting the validity of that mode of reasoning.

Mathematical knowledge was credited as having a noble influence on the mind, as a way of liberating our thoughts from temper, curbing and limiting the sharp, annoying edges of a passionate character. Widening the range and disseminating its ideas among the competent individual members or groups of society, as it was seen from the writers of classical Political Economy, would produce, as a result, calm and peaceful relations between them and would promote barter at a higher level, where reciprocity (Theocarakis, 2008) would be the outcome of factors other than the cunningness of self-interest.

⁵ In his *Theodicee*, Leibniz, supports that human rationality is analogous to God's divinity. 'By the new infinitesimal analysis the geometers do only somehow imitate God' (in Stark, 1943, p. 34). For a discussion concerning the relation between political economy and theology in 19th century Britain see Oslington (2017). Cannon (1978) also points out that, for the period under consideration, 'Mathematics is a sign of truth; it is one of God's languages' (Cannon, 1978, p. 267). Lastly, a more general approach of the link between economics and religion is offered in Dow (2005).

'[T]he calm and dispassionate interest with which they [sciences] fill the mind renders them a most delightful retreat from the agitations and dissensions of the world, and from the conflict of passions, prejudices, and interests in which the man of business finds himself involved' (Herschel, 1830, p. 16).

The image of a peaceful society characterised by a harmony of interests among its parts ought to be approached as a deeply rooted ideological element of mathematical justification. The fact that such a society is not present or realised did not discourage John W. Herschel from illustrating the necessary logical requirements of its existence. Thus, in more or less the same spirit as Leibniz, Herschel revisits the issue of blending and synthesising the competed interests between individuals and society, alluding to the political extensions of accepting the assumptions needed for the paradigm to operate within reason. The discussion of the mid-19th century regarding the interpretation of mathematical ideas had certainly focused on the relations between natural objects, but its results were also mirrored upon society and extended upon an ideal state of behavior.

'There is something in the contemplation of general laws which powerfully induces and persuades us to merge individual feeling, and to commit ourselves unreservedly to their disposal; while the observation of the calm, energetic regularity of nature, the immense scale of her operations and the certainty with which her ends are attained, tends, irresistibly, to tranquillise and reassure the mind, and render it less accessible to repining, selfish, and turbulent emotions' (Herschel, 1830, p. 16).

Herschel addresses here two very important points, as far as the general mathematical view of society is concerned. The first and less straightforward corresponds to the occult quality our contemplation of natural order is affiliated with. It would have been plausible to infer that the influential characteristic feature – with which the reflection on general laws is associated – on individual behavior is, on the one hand, certified but on the other, pursued. The above passage implies that the noble and valuable consequences of mathematical reasoning act upon the individual's character in such a manner, causing all distinct subjective opinions to be self-willingly mitigated under the unifying effect of natural and undeniable truth. Secondly, in psychological terms, individuality is supposed to disengage from all evil qualities (selfishness, turbulent emotions) that do not permit the unification of interests under a common purpose. Therefore, pure scientific knowledge could frame the issues of political economy and would concentrate upon an ideal image of society, illustrating a state of mind which, though not historically present, is openly claimed and theoretically attained. According to this interpretation, general laws, whether confirmed by evidence of experience or not, would have been imposed by necessity as a form of ideology.

3. A *right* mathematical theory for economics

Elemental aspects of ideology in mathematical thought can be traced within the mid-19th century debates in Britain, concerning the nature of its knowledge. Joan L. Richards' (1988) *Mathematical visions: the pursuit of geometry in Victorian England* stands out as one of the most thorough treatises with reference to the major controversies on the different mathematical perspectives, which was carried out among contemporary natural philosophers, at a time when several important scientific advances – such as non-Euclidean geometry – were about to step up, gaining broad and rapid recognition. The author offers a historical

account of the open-ended intellectual debates concerning the ontological basis of mathematical knowledge, pondering its effects on education. By the 1870s, she concludes, the Euclidean foundations of geometry had been vividly questioned, while geometrical conceptions were progressively interpreted in a formal rather than a descriptive way. Amongst these two broadly conflicting views, numerous other approaches can be identified as byproducts of an intense intellectual interaction among scholars of science. Such a decisive shift on mathematical vision was able to convert the general understanding of natural as well as social life. In a meaningful way, this controversy is indicative of the ideological ground upon which the broad range of human knowledge has been erected and it provides new unconventional ways for deepening our understanding of its relation with the epistemological aspects hidden behind the historical process of gradual transition from political economy to economics (Milonakis and Fine, 2009, ch. 12; Halevi et al., 2011).

The dispute between mid-19th century mathematicians in England was primarily focused on the manner in which true human knowledge is attained. It was taken for granted that truth was itself – as God was – single and undivided and that geometrical reasoning could reveal aspects of its unifying singular nature. Science was considered as the norm towards it (Cannon, 1978, p. 271). During such a process, a significant part of this intellectual debate was framed by two incompatible epistemological approaches. The first was the nativist, which roughly asserted that true knowledge of natural realities was somehow innate to them, whereas reason served as the guiding light towards it. The belief in the intrinsic qualities of the matter can also be found in some of Thomas De Quincy's (1844) early contemplations on utility as a property inherent to commodities. The second was the empirical approach, which argued in favor of experience as a means of verifying knowledge through senses. William Whewell, in his work *The philosophy of inductive sciences* (1837) supports the nativist view, elaborating upon the fundamental conception of necessary truths. Whewell resorted to statements of undisputable certainty in order to form a solid basis for human knowledge, from which all other subjects could stem. He consequently maintained that, owing to its occasional character, experience could not procure a safe road towards the ideal qualities of truth, and to furthermore generate the required level of universality.

'Necessary truths must be universal truths. If any property belongs to a right-angled triangle necessarily, it must belong to all [...] necessity and universality cannot possibly be the mere results of experience [...]. That from experience we obtain much knowledge which is highly important, and which could not be procured from any other source, is abundantly clear [...]. Experience must always consist of a limited number of observations [...] being thus unable to prove a fact to be universal, is [...] still more incapable of proving a truth to be necessary. Experience cannot indeed offer the smallest ground for the necessity of a proposition. She can observe and record what has happened; but she cannot find, in any case, or in any accumulation of cases, any reason for what must happen. She may objects side by side; but she cannot see a reason why they must ever be side by side [...]. She contemplates external objects; but she cannot detect any internal bond, which indissolubly connects the future with the past, the possible with the real. To learn a proposition by experience, and to see it to be necessarily true, are two altogether different processes of thought' (Whewell, 1837, pp. 61-64).

As it becomes apparent, the idea that truth must hold under any circumstances provides sufficient reasons for the property of universality to be established. Experience, on the other hand, is considered to be unqualified to testify for truth's necessity on the grounds that human senses are bound by 'a limited number of observations' lacking, thus, the appropriate legitimacy to generate catholic statements. In the previous passage, however, as can be observed, the efficacy of experience is denounced, since it "cannot see a reason" able to connect the cases procured by observation. Necessary truths acquire this property beforehand, as a precondition, but it is this very act of selecting one instead of another process of thought that makes room for ideological considerations. What if choosing this approach, instead of the other, could offer some potential for better results? What is the criterion for judging it? The prospect of this answer may lead us to moral as well as political arguments.

Whewell's use of reason is somehow forced, as if a previously imposed order of things had been authoritatively dictated. Something that stands beyond our range of influence compels us to allude to a particular succession of things. Causes and effects, Whewell demonstrates, are recognised through senses, but it is the very idea of *causality* that has its origin in the mind itself, which has already been formed as a category that prompts us to pursue for it. Thus, our observation is ultimately preconceived. 'But that every event has some cause, experience cannot prove any more than she can disprove. She can add nothing to the evidence of truth, however often she may exemplify it' (Whewell, 1837, p. 167). The metaphysical bond between observations could not be derived directly through senses but was, instead, necessitated as a crucial mystical element which was denied by the empirical approach. John W. Herschel stands as a representative of the opposing belief, that true knowledge can spring from experience and can be mediated through science.

'The truths it [science] is conversant with are necessary ones, and exist independent of cause. There may be no such real thing as a right-lined triangle in space; but the moment we conceive one in our minds, we cannot refuse to admit the sum of its three angles to be equal to two right angles [...]. No one causes or makes all the diameters of an ellipse to be bisected in its centre [...]. But in natural science cause and effect are the ultimate relations we contemplate; and laws, whether imposed or maintained, which, for aught we can perceive, might have been other than they are [...]. We have thus pointed out to us, as the great and indeed only ultimate source of our knowledge of nature and its laws, EXPERIENCE; by which we mean not the experience of one man only, or of one generation, but the accumulated experience of all mankind in all ages [...]. Experience once recognised as the fountain of all knowledge of nature, it follows that, in the study of nature and its laws, we ought at once to make up our minds to dismiss as idle prejudices [...] any preconceived notion of what might or what ought to be the order of nature in any proposed case, and content ourselves with observing, as a plain matter of fact, what is.' (Herschel, 1830, pp. 75-78)

What is actually claimed, is that the true meaning of scientific ideas stems autonomously or even, naturally, from its own reasonable properties. According to Herschel, no one causes its appearance or controls its exposure at will and, at the same time, no subjective opinion intervenes. The Victorian scholar held that science fulfills this noble purpose, operating like a vehicle which leads us safely to truths of unassailable validity. As a consequence, knowledge as such, is ready to be perceived through immediate laws or norms able to be observed by

those who have accepted to wear the appropriate glasses for seeing it. Contemplation concerning a potentially alternative order or state of things is forbidden and perceived as subjective prejudice. The observer is obliged to remain impartial, starting with gazing serenely at the image of a lawful natural state and the aim of contemplation is to examine these laws under the belief that they represent the truth and not a predefined belief.

These two theories, apart from their epistemological differences, reveal certain distinct attitudes of scientists themselves. In the first one, knowledge is supposed to be out there waiting to be discovered, whereas in the latter, the very meaning is procured by the individual mind in which the appropriate method has been cultivated. Of course, in both cases, no one is free to express prejudgment while he is strongly obliged to accept that his own theory of approaching knowledge is the right one. A commonly accepted yardstick for discerning between falsity and truth was thus gradually formed and more than that, was also about to be applied to the field of Political Economy.

'I maintain that is only by going back and reconsidering the primary notions of the science that we can arrive at a true theory of economy, and be enable to distinguish between the true and the false [...] The laws of political economy must be mathematical for the most part, because they deal with quantities and the relations of quantities' (Jevons, 1862, pp. 479-480).

Here, Jevons seems to offer his own answer to a historical argument posed by Scottish mathematician Thomas Reid in his *An Essay on Quantity*, in which he denies the application of mathematical reasoning to subjects relating to moral ideas of virtue and merit. "Pain and pleasure admit various degrees, but who can pretend to measure them?" (Reid, 1748, p. 506). The enthusiastic spirit of Jevons, on the other hand, also made him to acknowledge that unless an economist is equipped with the appropriate mathematical theory only then can he study this science of quantities in an upright manner.

'Thus the chief difference between the old and the new doctrines is, that the old ones involve a crude and partially false mathematical theory and the new ones, as I venture to maintain, a true mathematical theory. This difference arises I believe, from overlooking the importance of a thorough analysis of the notion of utility' (Jevons, 1862, p. 480).

One, however, may wonder, what were 'the old and the new doctrines' to which Jevons relies? In Britain, the analytical method of inquiry, implied in the aforementioned part, was introduced with a relative delay. Olson (1971) has illustrated that the retarded arrival of analytic mathematics and the complete substitution of ancient or "synthetic" geometrical thought were due to the prominent role the Scottish mathematicians attributed to Common Sense, i.e. to the well-rooted habit of offering sensory referents for all meaningful terms.

Besides the intriguing question of how mathematical truths were actually founded, the vast majority of the examples offered by scholars in Britain, 'were consistently geometrical as opposed to analytic' (Richards, 1988, p. 39). The descriptive approach which was almost unarguably followed in their writings, permitted for a lower degree of abstraction, alluding to concepts – like that of 'space,' for example – which corresponded more easily or even immediately to our senses. In the years to come, the reluctant reception or even disdain of symbolic algebra can also be found in the observations made by Benjamin Jowett when reviewing Alfred Marshall's early draft of the *Principles* (Whitaker, 1972). In his

correspondence with Marshall, Jowett expresses some sort of irritation concerning the use of algebraic symbols in political economy.

'Will you be surprised at my attacking you about Symbols? [...] I seem to see that various persons such as De Morgan and Boole, have tried to applied mathematics to subjects which did not admit of their use & have rather deluded themselves & others [...] Now I do not object to their application to Political Economy, provided they are not regarded as a new method of discovery, but only as a mode of expressing a few truths or facts which is convenient or natural to the few whose minds easily adopt such symbols. Political Economy is human & concrete & should always be set forth in the best literary form: the language of Symbols may be relegated to notes and appendices' (Whitaker 1996, letter n. 148).

The quoted part constitutes a synopsis of the assessment espoused by many academic circles in mid-19th-century England, while it also makes its way prophetically, since Marshall's *Principles* were eventually published in the manner dictated by the last sentence. Diagrams, as geometrical demonstrations, were put altogether in footnotes, while mathematical analysis and differential calculus were placed in a distinct Appendix at the end of the book. Obviously, the above decision is opposed to that of Jevons' who interpreted "the symbols of mathematical books [as no] different in nature from language" (Jevons, 1871, p. 5). The impact these developments had on the subject matter of political economy was striking. Traditional issues like those on value or distribution were about to be restated and reformed following different methods of inquiry, influencing the entire terrain of political argumentation.

Two questions effortlessly arise with regard to what the difference is between geometry and analysis. Should economists be concerned or able to distinguish between the two? Our answer to the second question is affirmative, adding that the changing views encompass crucial ideological aspects that fit to the development of the utilitarian ideals of marginalism.

4. Essential differences between synthetic and analytical perspectives

In this section we find it most appropriate to present various seminal ideas and elementary aspects of the great discourse about the relation between these two sister arts of mathematics. The controversy is very old and extensive.⁶ However, a brief or introductory sketch of the essential features of old geometrical thought is considered important for the history of economic ideas. The theoretical inclination of neoclassicism towards mathematical analysis can be satisfactorily uncovered if the characteristic qualities of these categories (geometry and analysis) are appreciated.

The analytical method has a long history that goes back to ancient Greek philosophy and geometry (Hintikka and Remes, 1974). The word 'analysis' is complex, stemming from the Greek phrase *ἀνάπαλιν λύσις* which means, 'reduction backwards'. According to a famous mathematical compiler of the antiquity, Pappus from Alexandria:

'[I]n analysis we assume what is sought as if it has been achieved, and look for the thing from which it follows, and again what come before that, until by regressing in this way we come upon some of the things that are already known'.

⁶ For an exhaustive inquiry of the subject see Kline (1972).

Hence, we consider having already reached what we seek as being found and, afterwards, we attempt to proceed rationally until we arrive to a conclusion that is known beyond doubt. In other words, the truth of what we seek is *a priori* declared, but it would not be established until it is logically connected to a certain fact of knowledge. Conversely, analysis is followed by synthesis.

[B]y reversal, we assume what was obtained last in the analysis to have been achieved already, and, setting now in natural order, as precedents, what before were following, and fitting them to each other, we attain the end of the construction of what was sought' (in Henderson, 1993).

Exactness and rigorousness are being furnished through the reverse process of synthesis – *constructio* in Latin – as it was started from a known fact, building up a consequential reasoning towards what the starting point was in the process of analysis. With the latter, the product of analysis could be fully demonstrated, and this may explain synthesis' close intimacy with geometrical constructions using the ideas of line-segments, perfect circles as well as other figures. Simple geometrical demonstrations offered a descriptive sense to the proposed solutions that was essentially needed to serve as a basis for their existence outside the mind of practitioners and natural philosophers, filling the need for sensory evidence of the proposed solutions. In this way, solutions were being *demonstrated* not just logically proved.

For centuries, that old⁷ way of geometrising was considered as one of the highest arts. With the publication of Descartes' *La Géométrie* (1637), however, the ancient analysis was rejuvenated and utilised in order to take a different step away from the descriptive qualities of human intelligence as a necessary requisite for validating its outcomes. By then, according to the main trend, analytical results were contemplated by the implementation of Euclidean geometry, that is, by the use of simple figures and line-segments, appearing as unmediated and direct affections in the mind. The need for constructing a geometrical solution was necessitated by the idea that its visibility constituted a basis for its existence. Descartes' novel canon, however, consisted a clear departure from this ancient-long tradition, for it was developed in order to treat the problems of geometry within a context of analytical and algebraic conceptions (Bos, 2001). Such uprooting was not a mere change of style but rather of essence reflecting the epistemological views on the nature of the attained knowledge. The groundbreaking canon maintained that geometrical problems could be transformed into equations of knowns ($a, b, c...$) and unknowns ($x, y, z...$) and then proceed by resolving it, i.e. analysing – *resolutio* in Latin – as if the problem had already been solved (Bos, 2001, p.303). Furthermore, Descartes asserts that the product of the line-segments a and b must be conceived in order for a new image of an \overline{ab} line-segment, and not a framed area, to be represented in our minds. This would reduce the faculties of our senses for illustration. After all, affirmation through experience couldn't be justified completely as a geometrical rule, since there was no particular reasoning for the imposition of a necessary transformation of two line-segments into an area. This example is striking in showing how classical geometry metamorphosed itself into algebraic equations, with all the unknowns treated as if they were already known through the comprised relations with the givens – *data* in Latin – of the problem at hand. Once more, the analytical method was used as a means of abstracting the features that would allow for an interpretation of results through one's senses.

According to Redman (1997, p. 131), nineteenth-century scientific milieu envisaged the analytical method as a generalised application of chemistry in every other field of knowledge, replicating the process in which chemical compounds are resolved into its

⁷ The term 'old geometry' is used to distinguish it from its later *analytical* counterpart.

elements. Resolution (analysis) begins with an equation or symbolic relational form, the validity of which is ultimately derived as a logical consequence of a hypothetical *a priori* accepted truth. A symbol is thought to be capable of representing and acquiring any potential meaning, either quantitative or qualitative. Thus, we ultimately end up with a complete abstraction or a formal equation, between the entities considered, in which the mathematical reasoning is inflicted as if being part of their nature. Analytical train of thought substitutes for all other qualities or features. In this respect, various historically specified terms of Political Economy were re-substantiated into a new form and theory that, whereas it looked like merely wearing a new garb, it was absolutely more than that.

On the other side, old geometry acquires a series of different characteristics. Firstly, it is closely tied to what our senses perceive as a three-dimensional space. Secondly, its diagrammatic solutions are demonstrated and arrested by our senses and, thirdly, it is mainly concerned with magnitudes and figures possessing a meaning of their own – no matter how simple these may be – also capable of being captured by our senses. Furthermore, an elegant demonstration of a geometrical solution may also satisfactorily respond to our need for aesthetic quality but moreover, all its terms and concepts are designated as sensory referents. Geometrical figures cannot be found in nature and, thus, should not be confused with that part of knowledge the validity of which is being found in experience. But, whether they constitute mere products of our mind or are able to be found as natural entities, they are observable and correspond immediately to our understanding as such.

Be that as it may, Isaac Newton's openly expressed distaste for analysis and his criticism against Cartesian symbolic methods, as the latter were presented in *La Géométrie*, may therefore be received without any sort of surprise. Whereas a complete demonstration of Newton's aversion against the method of analysis falls outside the scope of our investigation⁸, his predilection for 'synthetic geometry' can be sufficiently stressed by the following:

'[F]or anyone who examines the constructions of problems by the straight line and circle devised by the first geometers will readily perceive that geometry was contrived as a means of escaping the tediousness of calculation by the ready drawing of lines. The Ancients so assiduously distinguished them one from the other that they never introduced arithmetical terms into geometry' (Newton, 1972, V, p. 429).

'Present-day geometers indulge too much in speculation from equations. The simplicity of these is a consideration belonging to analysis: we are here occupied with composition, and laws are not to be laid down for composition from an analytical standpoint. Analysis guides us to the composition, but true composition is not achieved before it is freed from analysis. Let even the slightest trace of analysis be present in the composition and you will not yet have attained true composition. Composition is perfect in itself and shrinks from an admixture with analytical speculations' (Newton, 1971, IV, p. 477).

Newton's critical appraisal concerning the new mathematical method can be found permeated throughout his mathematical works. Yet, the cited passages are indicative of his reluctance towards the use of analytical method as a primary guide of reasoning and as a tool of scientific discovery. After all, whereas analysis deprives our senses from aesthetic elegance, one of the main reasons for its subordinating role consists in that it cannot sufficiently

⁸ Guicciardini (2009) constitutes one of the most lucid and comprehensive inquiries on the subject of Newton's mathematical thought. Many of the views expressed here, own a lot to his inspiring work.

establish a certain ground for true laws. Newton rejected the use of Cartesian symbols for solving geometrical problems after having them reduced into equations and without providing any plausible geometrical demonstration in the end. Knowledge of a solution and its truth shouldn't be dependent on equations.

'To denote a root of a proposed equation geometrically, or insofar as a geometer should gather from the construction of an equation a solution of a kind propoundable and demonstrable without knowledge of the equation' (Newton, 1976, VII, p. 251).

In that way, old geometry was absorbed by analysis and demonstration (composition) would no longer be necessary. That approach actually paved the way for solutions in higher dimensional spaces, of which we have no perception.

Under this light, the phrase that Alfred Marshall has placed in a reply to Arthur Bowley, immediately after his famous six-step rule on how to use mathematics in economics, saying 'I believe to Newton's Principia methods because they carry so much of the ordinary mind with them' (Whittaker, 1996, p. 130) and which the editor of his correspondence has found to be 'obscure'⁹, may no longer appear as enigmatic. In the Continent, even before Newton's death, the Newtonian approach was already becoming outdated. British scholars, on the other hand, bypassed new developments in mathematical thought with flamboyant indifference. Newton's influential legacy, though in retreat, was still present in mid-19th century Britain and this can be easily ascertained by the fierce criticism on the educational value of mathematics, unleashed by Scot philosopher William Hamilton.

Hamilton had foreseen the arrival of Continental or new method of mathematics to Britain since, after traveling to Germany, he had the opportunity to get in touch with the contemporary trends in philosophy and thought (Laita, 1979). His main arguments are based on the notion that mathematical reasoning is concerned with 'relations of quantities' and '[taking] no account of things but is conversant solely with certain images' instead of 'realities'. In addition, he turns next to the idea that mathematics is merely an 'explicative' art since it departs from a hypothetical definition instead of driving us towards it, and since its universality is 'not established on any a posteriori process'. Hence, it seems like our reasoning proceeds in mere forms devoid of particular meaning 'contemplating the general in the individual' (Hamilton, 1836, pp. 273-274).

'Mathematics, departing from certain hypotheses, and these hypotheses exclusively determining every movement of their procedure, and the images or the vicarious symbols about which they are conversant being clear and simple, the deductions of the sciences are apodictic or demonstrative; that is, the possibility of the contrary is, at every step, seen to be excluded in the very comprehension of the terms [...]. The symbolic notation of arithmetic and algebra, is, that it has relieved the mind of all intellectual effort, by substituting a sign for a notion, and a mechanical for a mental process.' (Hamilton, 1836, p. 275).

The belief that algebraic symbols were capable of acquiring any potential meaning and imitating the essential features of anything our mind was able to reflect as quantity or degree of magnitude (with less and more), was gradually gaining recognition. For a long time,

⁹ 'The aspect of Newton's methods that Marshall had in mind remains obscure' (Whittaker, 1990, p. 130).

mathematicians and philosophers were quite reluctant to go on naming symbols after moral sciences, but extending the ideas of analytical thought in the field of Political Economy was a matter of time. Not to mention that the need of mathematical analysis itself to extend onto other fields of knowledge seems to have troubled the mind of Descartes himself. As we learn from his biographer, Adrien Baillet, Descartes' 'own experience had convinced him a long time ago of the small benefit of mathematics, especially when men study it only for themselves, without applying it to other things' (Baillet, 1691, p. 111). A science of social affairs would certainly have sufficed for this purpose.

Jevons constitutes an exceptional example of those who rushed into embracing the idea of a world that is different from our own, in which other potential geometries would have been applicable. As he asserts, 'in other imaginary worlds the geometrical conditions of existence might be still more strange' (Jevons, 1871, p. 481). The main argument pertaining to the solid grounds of mathematical knowledge was, thus, reversed so that, even if it cannot be founded in the experience of our existent world then, an alternative can possibly be imagined. Contemplating upon several other different worlds, in which the analytical outcomes may be applied, would gradually lead us to a complete divorce from the traditional approaches of Whewell and Herschel. Truth was no longer to be founded within the objects of inquiry nor in experience, but in mental experimentation. 'Whatever other doctrines may be true, this doctrine of the purely empirical origin of geometrical truth is certainly false' (Jevons, 1871, p. 482). The terrain was open for analytic exploration and application and the new method constituted the ideological basis of neoclassical thought, meaning that it assisted the changing of perspective to accelerate.

5. Mathematical analysis, neoclassicism and Marshall

It was the wide acceptance and warm reception of the abstract visions of mathematical analysis and analytical geometry that helped neoclassical ideas to spread and dominate. In the Continent, Cournot (1838) and Gossen (1854) constitute two noticeable examples among the growing number of thinkers who took the first strikingly impressive steps towards the construction of a new theory of social conduct, following the application of those techniques to political economic issues. Both pioneering treatises were extraordinarily technical for their era whereas in both, the elimination of the adjective 'political' from the title of the old science was proposed as an almost technical prerequisite for complete abstraction from conflicting interests to be attained. Cournot focuses on the issue of bargaining under different market structures and is far more elegant in treating mathematical tools. Gossen's work, on the other hand, comprises a more ambitious attempt to incorporate the totality of human action, but his presentation is quite tedious and, in times, hard to follow. Nevertheless, the ardent admirers of mathematical analysis were primarily concerned with offering a satisfactory interpretation of their resulted outcomes, so as the various non-quantified concepts of moral status to be covered. Human will and self-interest were reduced into symbolic language.

Cournot claimed that the application of differential and integral calculus would purify political economy from its several incompatible theoretical standpoints and would transform it into a 'science of wealth'. The polemic against the old-fashioned theorists such as Adam Smith, was justified on the basis of misjudgment and prejudice, as a battle between the old tradition which refuses to withdraw and the new ways of thinking.

'I intend to apply to them [theories] the forms and symbols of mathematical analysis. This is a plan likely, I confess, to draw on me at the outset the condemnation of theorists of repute. With one accord they have set

themselves against the use of mathematical forms, and it will doubtless be difficult to overcome to-day a prejudice which thinker, like Smith and other more modern writers, have contributed to strengthen' (Cournot, 1838, p. 2).

Any philosophical argument, or even Newton's critical stance, was seen as a parochial obstacle to the ongoing advancements of scientific progress. As far as Political Economy is concerned, Cournot continues, the prejudice lies on most peoples' false belief, that analysis inevitably leads to elementary algebra and numerical calculations. The object of this new method, he asserts, is intended towards the derivation of 'relations between magnitudes' that would be expressed as 'functions'. Henceforth, the answers to questions posed by political economy will be provided by 'that branch of analysis which comprises arbitrary functions' (Cournot, 1838, pp. 3-4). In other words, according to this new interpretation, any idea concerning quantity or measurement might as well be left aside, in order for the quantification problem of the moral aspects of economic theory to be overcome. In this extreme level of abstraction nothing would have been specific, nor number – designating even the slightest sense of quantity – neither function.

Hermann H. Gossen has also been occupied with the relation between mathematics and quantification as an impediment to considering issues of political economy. The fact that the idiosyncratic thinker lacked the capacity of Cournot in mastering the new techniques did not prevent him from dedicating considerable space in his *Entwicklung*, applying analytical techniques to moral issues. In this context, the laws governing individual action were examined in close relation to the aim of maximum lifetime pleasure, through the optimal allocation of several time-consuming enjoyments. To succeed in this, Gossen departs from the old geometrical rules and embraces the new method without questioning the validity of its knowledge. Accordingly, individual action was demonstrated in the new-fashioned way of diagrammatic analysis. It was believed that the use of symbols allowed him to reflect upon the unquantifiable nature of pleasure, by forming general expressions of the investigated laws that ultimately determine human behavior at all times and places.

'[I]n geometry it is necessary to measure the actual dimensions of a given space in the real world in order to present its picture accurately. But such measuring is not required in order to elicit the laws of geometry since for this purpose it suffices to find, from the specific characteristics of space, means by which its parts can be mutually related. Similarly, in order to develop the laws governing enjoyment, it is not necessary to measure actually magnitudes of pleasure' (Gossen, 1854, p. 10).

Obviously, Gossen here refers to the new type of analytical geometry. In addition, he seems to suggest that analysis has assisted him in obtaining a complete solution of the long-lasting problem of value, the most vital issue in the field of political economy. By extending these rules to material as well as immaterial goods, he suggests, this science should no longer be called that anymore.

'The limitation [insofar] was imposed solely by the circumstance that it seemed impossible to formulate rules applicable above and beyond the material goods. The present conventional name of this science is no longer appropriate if we set aside this limitation and extend the purpose of this science to its real dimension – to help man obtain the greatest sum of pleasure during his life' (Gossen, 1854, pp. 38-39).

Hence, by generalising the features of analysis to immaterial and, consequently, non-quantified goods, and by abstracting from all other features that could determine human behavior, Gossen intended to transform political economy into a “science of pleasures” that would be deprived of issues of ideological dispute. Analysis was enthroned as the uncontested sovereign of human behavior, no matter whether this belief was founded on the quicksand of the unresolved issues of the nature of mathematical knowledge.

Walras was also in search for a new name of political economy. He, too, like Gossen, endorses the issue of scientific truth as the ultimate determinant of the field while, like Cournot, he goes against Smith’s old-fashioned interpretation of the subject.

‘The primary concern of the economist is not to provide a plentiful revenue for the people or to supply the State with an adequate income,¹⁰ but to pursue and master purely scientific truths’ (Walras, 1874, p. 52).

Apparently, the priority that was given to scientific techniques was total. Political economy ought, according to Walras, to no longer preserve the interests of the people but, on the contrary, it should pledge its belief to the scientific truths of analysis, no matter of its social outcomes. The new method substituted the view of empirical description and historical examination, but also changed the manner in which economic problems were posed. Indeed, the idea that mathematical analysis could have discovered problems that common sense cannot, has also been asserted by Edgeworth (1889, p. 547). He too upheld that the new method would help economists to ‘discover loose quantitative relations of the form: x is greater or less than y ’ and not a particular numerical result or even a specific order of magnitude. The new theory ‘assists us in conjecturing the direction and general character of the effect which changes [...] The truth in its generality is more clearly contemplated by the aid of diagrams’ (Edgeworth, 1889, pp. 539-540).

To our knowledge, Dardi (2006; 2016) gathers the only points of reference in which the method of analysis has been approached in sharp contrast to Alfred Marshall’s tendency towards intuition and imagination. Within this revolutionary era of rapidly changing methods of economic reasoning, the late Victorian figure of Marshall stands alone by his peculiar approach towards the role of mathematics in economic theory. It should, therefore, come as no surprise that Marshall is conspicuous by his absence from the otherwise exhaustive treatise of Ingrao and Israel (1990) on equilibrium. Marshall’s theory is solely mentioned in chapter 8 where Hick’s contribution on dynamic equilibrium is presented. The authors admit that they ‘shall take this opportunity to fill the gap in [their] treatment’ (Ingrao and Israel, 1990, p. 217) and maintain that Marshall saw the ‘impossibility of representing [...] social systems through a broad and sophisticated mathematical apparatus’ (Ingrao and Israel, 1990, p. 218). This is only partly true, however, since his hesitant stance is also attributed to the nature of mathematical analysis in itself and not just to its product, i.e. to the unrealistic occasion of static equilibrium and stationary state. This is also evident from the fact that in his investigation of the effects of possible changes in supply and demand, Marshall stresses that ‘the unsatisfactory character of these results is partly due to the imperfections of our analytical methods’ (Marshall, 1961, p. 809).

What is more, in Weintraub (2002, p. 24) we read that Marshall’s own growing skepticism against the application of mathematical analysis to economics, constitutes a minor *Das Alfred Marshall Problem* for historians. However, to those aware of the disputes regarding the validity of mathematical truth, an invaluable comment made by Groenewegen

¹⁰ Walras refers to Smith (1776, IV. Introduction).

may be of help in clearing out his seemingly misconceived or even 'schizoid', as Blaug has suggested (1962, pp. 398-9), attitude.

'Alfred Marshall was to apply his mathematics to economics with care, with caution and with a considerable degree of skill [...] he preferred geometry more for this role than the terse language of algebra and the calculus' (Groenewegen, 1995, p. 94).

It should have been quite clear by now that the aforesaid difference between geometry and analysis is not just of appearance, but mainly of perspective. Marshall's *Principles* were written so that mathematical analysis would not interfere with the theoretical approach presented in the text, for he did not trust its long trains of reasoning imposed to economic theory (Marshall, 1961, p. 781). For example, in a letter to Flux, he added, 'my confidence in Cournot as an economist was shaken when I found that his mathematics [regarding Increasing Returns] led inevitably to things that do not exist and have no near relation to reality.' (Whittaker, 1996, letter n. 564) Additional evidence from his correspondence may also show that his conscious urge to favor the old techniques was based on the fact that that he had disavowed the emerging trend of analytical treatment of economic questions.

In replying to Foxwell, he writes that *Mathematical Psychics* (1881) 'on the whole disappointed' him (Whittaker, 1996, letter n. 98). whereas in another letter, in which Edgeworth himself pressures Marshall to offer him a straight answer as far as his opinion regarding geometry and analysis is concerned, the latter replies:

"[A]s regards the applications of geometrical rather than analytical reasoning I have not such decided views as you suppose.

When tackling a new problem I generally use analysis, because it is handier. And in the book which I am just going to begin to write, I shall retain (in footnotes) a little mathematical analysis, for questions which I can't reduce under the grasp of curves. But – partly because, curves requires no special training, partly because they bear more obviously on the science of Statistics, I intent never to use analysis when I can use geometry." (Whittaker, 1996, letter n. 81)

The advantages of common-sense reasoning are here underlined while Marshall resists against the temptation offered by the extreme level of analytical abstraction to drive through answers posed by economic questions. He is clear about his preference, and the reasons that have enabled him to do so deviate substantially from the cruel explanation of Marshall's 'harboured ambition to be read by businessmen', given by Schumpeter (1954, p.722). Besides, from his reply to Walras, it is easily understood that his purpose in placing mathematics at the back was methodological. '[T]he right place for Mathematics in a treatise on Economics is the background. But I think it is most desirable that different seekers after truth should find different routes' (Whittaker, 1996, letter n. 273). Marshall's route towards truth, was certainly not passing through mathematical analysis.

6. Epilogue

Irving Fisher (1892) has carefully distinguished what he designates as the mathematical method of mainstream economic theory, which 'has reference to the use of symbols and their operations'. From his point of view, 'the introduction of mathematical method marks [...] the

entrance of political economy on a scientific era' (Fisher, 1892, pp. 105-109). Building up an economic theory can either be a process of the mind, of history, or of both. But the construction of neoclassical theory, as I have attempted to demonstrate, was particularly tailored under the ideological light of analytical mathematics.

Due to this ambition to understand the ideological aspects of mathematics in neoclassical economics, the distinction between synthetic and analytical reasoning was put forward. Mathematics, more than any other discipline, has influenced the modern state of economic thought. For instance, classical theories have, to a great extent been restated and interpreted in the new mode of analytical reasoning. But as has insofar been suggested, there is something essentially more than that. Mainstream economic theory does not constitute a mere restatement of the old and classical doctrines, but it is also the product of this same toolbox with which it is expressed. In that brief, mathematical analysis has paved a significant part of the long way towards the ideal formation of neoclassical economic thought, which in return, has been consequently adapted main aspects of the analytical perspective. To see that, the investigation of both histories of thought, economics and mathematics, must necessarily be studied synthetically and in collaboration.

My research agenda has drawn heavily on the idea that the foundations upon which human knowledge is grounded are highly contested. This fundamental acceptance left considerable room for fresh considerations and procures a great opportunity to investigate and revalue the history of mainstream economic theory as the ideological consequence of analytical mathematics. The history of analysis can bring to the fore several introspective aspects of interpreting society, which are found to be compatible with the main principles of neoclassical thought. In the narrow context of this paper the main source of ideology corresponds to the attempt of analytically interpreting the moral status of mathematical results. Be that as it may, this is just a step towards this more general purpose.

Acknowledgements

I am grateful to Sheila Dow, Brian O'Boyle and Rafael Galvão de Almeida for their helpful comments on the *Economic Thought* Open Peer Discussion forum

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SUGGESTED CITATION:

Missos, Vlassis (2020) 'Mathematical Analysis as a Source of Mainstream Economic Ideology' *Economic Thought*, 9.1, pp. 72-95. <http://www.worldeconomicassociation.org/files/journals/economicthought/WEA-ET-9-1-Missos.pdf>