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***The Normative Origins of General Equilibrium Analysis
or, Walras's attempts at reconciling economic efficiency
with political justice***

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My sole aim is to show that the ‘present-mindedness’ of our contemporaries tends to blind them to the original purport of past texts. (Jaffé, 1981, p. 244)

Introduction

This essay is an attempt to report on one aspect only of a large project initiated by a team working at the Walras-Pareto Centre of the University of Lausanne; this project is devoted to an history of the relationships between general equilibrium formal models and their widely differing epistemological, philosophical and even political underpinnings. The central aim of this large project is to gather contributions on general equilibrium, its spread and its various uses since Walras. General equilibrium is considered here not as a mere technique but as ‘contextualised knowledge’, i.e. as a combination of theoretical references, technical standards and, of course, economic and social representations. The goal of the project is not to provide yet another history of general equilibrium as a purely theoretical object. It is more about pointing out the interpretative contexts and the technical instruments that shaped, and still shape, the uses of general equilibrium within ‘theoretical and ‘applied’ economics as well as outside of economics *stricto sensu*.

As a preliminary exercise, this essay intends much more modestly to revisit the old dispute about the normativity (or not) of Walras’s general equilibrium model. In other words, is this magna carta of economic theorists (to use Schumpeter’s old *dictum*) ‘a scientific and positive description of the real world’ (Morishima) or ‘a property of the way we look at things, not a property of reality (Lucas in Snowdon and Vane, 2005, p. 281) as most modern economists would see it; or is it, in Walras’s own words, ‘a scientific ideal’ (or more properly an ‘ideal fiction’) towards which the *réalité* should be brought closer and closer by way of proper prescriptive economic policy measures to solve ultimately the so-called *question sociale*? Should such a ‘realistic utopia’ be the correct interpretation of Walras’s powerful and initial intuition, the fate of this epitome of all mathematical models would be rather extraordinary. Deprived very rapidly by Pareto from its connection between social justice and market efficiency (however weak Walras’s own theory of justice actually is), Walras’s general equilibrium analysis was eventually resurrected in the late thirties to become, with rational choice theory, one of the corner stones of modern economic theory which attempts to draw a particular impermeable boundary between a positive, mathematical and hence scientific

economic theory and all normative issues basically off-limits for ‘serious’ main-stream economists. In fact, the traditional reading of Walras was until recently strictly restricted to his *Elements of Pure Economics* (even for those of us who can still read French!). As a side effect to i) recent – and not so recent – attempts at ‘socialising’ again market mechanisms and ii) the publication of Walras’s collected writings, Walras’s early attempts at connecting market efficiency and social justice has been under scrutiny again. This presentation is an attempt at discussing some aspects of the fundamental meaning of general equilibrium theory as conceived by Walras (and not by some latter-day users of the cult instruments).

The essay is in four parts.

Part I presents the general methodological framework in which the paper is set and briefly recalls the normative/positive debate around Walras’s initial version of general equilibrium. Part II re-examines briefly the conclusions of the 1980 normative/positive debate initiated by Jaffé around the connection between Walras’s general equilibrium model and his theory of justice; Part III examines in some detail some recent research on Walras’s philosophical and epistemological background which seem to tip clearly the balance in favour of Jaffé’s interpretation of the overall Walrasian venture. In part IV, some remarks on Walras’s own version of his stability analysis (his famous *tâtonnement*) are offered as an illustration of the algorithmic – and not realistic – nature of his price adjustment mechanism. Some concluding remarks are then offered to wrap up a still very provisional paper.

1. Methodological Framework: Syntax and semantics instead of syntax without semantics

The general research programme (of which this essay is a very small part) intends to examine the evolution of the technical apparatus and the successive and parallel epistemological shifts the general equilibrium model underwent from the 1870s to the early 1950s. As a first approximation, it is argued that a similar technical apparatus has been used within sometimes widely different epistemological contexts and with very different objectives in mind. The central hypothesis of our research suggests that these various epistemological backgrounds give in fact a very different cognitive status to successive general equilibrium formulations based on broadly the same theoretical model. More than increasingly sophisticated variations on the same theme, we are in fact faced with so-called ‘homonymous’ general equilibrium models. As soon as these are set within their respective epistemological framework (organising the links between economic ‘theory’ and the ‘real world’), the latter becomes part of the interpretation attributed to the theoretical model. To detect these homonymies is in fact to outline the history of the various interpretations given to the link between these successive versions of general equilibrium and the ‘real world’. In a nutshell,

the remarkable technical progress brought about by a century of general equilibrium theorising can only be properly understood if set within the epistemological frameworks explicitly or implicitly used by nearly four generations of theorists. In fact, in the field of general equilibrium, the history of the relationship between epistemological changes and theoretical progress remains to be written.

Such an historical perspective requires three different but interdependent analytical levels:

- the understanding of the developments of the theoretical apparatus of general equilibrium model;
- the understanding of the successive theorists' respective epistemologies as well as the philosophical creeds to which they adhered;
- the understanding of the theorists' various 'visions' of the relationships between their models and the practical use they can be put to in terms of economic policy.

To put the same argument in slightly different terms, up until now, historians of economic thought have mainly work with diligence and care on the developments of the theoretical apparatus of general equilibrium analysis. Even if a great deal of work remains to be done in that field, the principal lines of the theoretical evolution of general equilibrium from Walras to Arrow and Debreu are broadly understood: after, for examples, Pirou¹, Schumpeter², Jaffé³, Patinkin⁴, Blaug⁵, Walker⁶, Negishi⁷, Weintraub⁸, Ingrao and Israel⁹, Dockès¹⁰, van Daal¹¹, Potier¹² and a host of younger scientists, we are beginning to have a better, if not perfect, idea of more than a century of the development of the syntax of general equilibrium theory. At the notable exceptions of the pioneering works of Ingrao & Israel, Mirowski and Amadae, we are however largely¹³ deprived of similar historical¹⁴ perspectives on the semantics of general equilibrium theory¹⁵.

¹ (Pirou 1934b;a;1938b;Pirou 1938a).

² (Schumpeter 1910;Schumpeter 1954).

³ (Jaffé 1935;1956;1964;1965;1967;1968;1971;1972;1975;1976;1977b;c;a;d;1980;1981).

⁴ (Patinkin1965).

⁵ (Blaug 1992;1997).

⁶ (Walker 1996).

⁷ (Negishi 1962;1977;1982;1994).

⁸ (Weintraub 1983;1985).

⁹ (Ingrao and Israel 1987;1990;Ingrao 1989).

¹⁰ (Dockès, 1996;2006)

¹¹ (van Daal

¹² (Potier

¹³ See however (Baranzini 2001).

¹⁴ Methodological studies of economic equilibrium theory do exist, but they seldom put in parallel the history of theoretical and methodological differences.

¹⁵ According to the usual meaning given to these terms in the field of grammar, the semantic and the syntactic components are regarded as distinct elements in the structure of a sentence. The syntactic component only describes the logical structure of the sentence without any reference to its meaning. The semantic gives an interpretation of the sentence by defining first and foremost the conditions of its validity.

To give a few examples, though using very similar mathematical techniques, Walras and Pareto differed widely on the use of their respective general equilibrium models to the extent that, in a recent article it has been argued (Bridel, 2005) that to speak of a Lausanne school (in the same sense as e.g. a Cambridge school) is complete nonsense: while the concept of a ‘Lausanne school’ is justified at a strictly theoretical level, such a portmanteau expression is inappropriate when the meaning of these theoretical instruments is taken into account.

During the socialist calculation debate friends and foes of Mises used the same post-Casselian version of general equilibrium (the same syntax!) to reach however opposite conclusions about the feasibility of market socialism. Morgenstern’s lethal review of Hicks’s post-Paretian version of general equilibrium suggested in *Value and Capital* is not simply about the type of mathematics respectively used by von Neumann and Hicks but also, and more importantly, about their intentions behind two widely different handlings of general equilibrium theory. Similarly, Amadae’s book on the *Cold War Origins of Rational Choice Liberalism* has recently offered a host of very exciting insights on the Arrow-Debreu axiomatic reformulation of old Walras’s general equilibrium model: based on rational choice theory (and no longer on some sort of exotic ordinal (or even cardinal) marginal utility) the radical change in syntax was certainly not independent from an even more radical alteration of the semantics of the model. Once and for all, all concern for verisimilitude, let alone empirical verification were cast aside; the only framework in which general economic equilibrium theory would bear fruit from the analytic point of view appeared to be that of an axiomatic redefinition of the model. Formal developments, and no longer some sort of wishy-washy interpretative content, were the ultimate criteria against which the validity of general equilibrium models should be gauged.

This paper intends precisely to put together the syntax and semantic of the oldest of all general equilibrium models in order to evaluate again its normative or non-normative nature.

II. What is positive and normative in Walras’s general equilibrium ?

Let us turn now to the specific topic of this essay: the drawn-out debate among historians of economic thought about the ‘realism’ of Walras’s own general equilibrium model. Or, more precisely to one aspect of this debate: the discussion about the degree of normativity attributed by Walras to general equilibrium theory. This debate is a good indication that the history of the purely analytical aspects of general equilibrium is not enough to understand its exact status as one of the main instruments in any modern economist’s toolbox.

Since William Jaffé’s ultimate article in 1981, and thanks to the impetus given by this patron saint of all Walras scholars, Walrasian studies have undergone a remarkable development. At the centre of this revival stand of course the scholarly 14-volume *Œuvres*

*économiques complètes*¹⁶ (the Lyon edition). Building on this solid basis, a new generation of Walras students has recently emerged on the Continent. Mainly based in French, Dutch and Swiss universities¹⁷, some of these researchers have tackled head-on some difficult and little-known theoretical, methodological and epistemological issues underlying not only Walras's pure economics but also his general approach to economics as a whole. There is now a substantial body of evidence indicating that Walras's general equilibrium model should not be viewed in isolation but as part of his much more ambitious project including his applied and social economics. As summarised by Dockès, "in order to understand the *Elements*, or at least how Walras conceived them, an intelligence of the rest of his work is necessary" (1996, pp. 8-9). One might also add that the *Elements* are also crucial in the understanding of Walras's *Etudes d'économie sociale* and *Etudes d'économie politique appliquée*.

Hence, some of the modern debates around Walras's general equilibrium model or the relationships between pure, applied and social economics are put in new and interesting perspectives. Moreover, these discussions are not restricted to historians of thought; they also provide a useful analytical background to the serious problems raised by various contemporary practitioners of general equilibrium models. In particular, is modern general competitive equilibrium (of the post Arrow-Debreu type) a good approximation of the functioning of decentralised competitive economies? Or is it only a fixed point, a benchmark or even a mere base camp from which economists are setting up their theoretical expeditions? Or, is this theory a genuine reference point, the value of which would be more normative than positive? Or, alternatively, and to paraphrase again Lucas's brilliant dictum, is equilibrium ... simply a property of the way we look at things and not of property of reality? (in Snowdon and Vane, 1998, p. 127; emphasis added)

Finally, and we come back to that in part IV devoted to Walras's *tâtonnement* mechanism, over this entire debate looms large the central question of the validity of a theory of exchange totally unable to explain the process through which even an abstract and decentralised market economy reaches the equilibrium positions it has successfully managed to define. Paraphrasing Edgeworth, and bearing in mind the negative results in terms of stability reached by Sonnenschein, Mantel and Debreu in the 1970s, what should one eventually think today of the theory of exchange set up by Walras "where, though the mode of motion towards equilibrium is indeterminate, the position of equilibrium is mathematically determined"? (1881, p. 4).

II.1 Walras's central urge to solve the 'question sociale'

¹⁶ Henceforth OEC. EEP (followed by a number) stands for the various French editions of Walras's *Eléments d'économie politique pure*.

¹⁷ Berta (2000), Bridel (1997), Costa (1998a, 1998b), Huck (1999, 2001), Lendjel (1997, 1998), Lhuillier (2000), Rebeyrol (1999); Jolink (1991); Baranzini (1993, 2001), Tatti (2000).

In 1909, a few months before his death, reflecting on his entire scientific work, Walras declared that the purpose of pure economics is simply to present a rigorously rational solution to the ‘question sociale’, i.e. to the reform of society to make it “just”. Heir through his father from the eighteenth century French enlightenments philosophers (in particular Condorcet), he strongly believed in Hayek’s ‘fatal conceit’, i.e. in the use of the sovereign efficiency of reason to solve both economic and social problems. He accepted neither the ‘crude empiricism’ of the Socialists bent on some romantic notion of social justice nor the individualism of the French orthodox liberal school. As early as the late 1850’s, Walras was already arguing for a synthesis of collectivism and individualism (arguing may be already for some sort of mythical ‘third way’!). This obsession with this synthesis underlines Walras’s entire work including, of course, his general equilibrium model that is only an instrument within this much larger and ambitious scheme. Hence, and not so paradoxically, general competitive equilibrium as the formal representation *par excellence* of a spontaneous market order has a largely ‘constructivist’ origin.

The solution to the ‘question sociale’ was posed in terms of social schemes necessary to correct what he saw as the flagrantly unjust distribution of income and property without, however, infringing on anyone’s individual liberty. The basis for this synthesis was his theory of justice inherited from his father and summarised in his famous dictum: *égalité de conditions et inégalité de positions*. Social justice requires that no one be allowed to infringe the rights of others to pursue unequal positions (his liberal side); but for these unequal positions in society to be just, the conditions under which they are reached must be the same for everyone (his mildly socialist bend).

Two old concepts of justice borrowed from what Walras calls ‘the good old [mediaeval] theory of natural law’¹⁸ are brought into the picture: namely, distributive justice and commutative justice. And the overall structure of Walras’s entire work, and in particular his famous trilogy between pure, social and applied economics reflects precisely the interaction between these two notions of justice. Hence, and on the one hand, general equilibrium and the *Eléments* contain the theoretical and abstract representation of an ideal and just economy from the standpoint of ‘commutative justice’; on the other, ‘distributive justice’ gets a logically earlier and separate treatment in his *Study in Social Economics* while the prescriptive policy measures necessary to make the market work according to the principles of ‘commutative justice’ are discussed in his *Elements of Applied Economics*. In passing, note that, logically, Walras was a life-long opponent to any functional marginal productivity theory of distribution. He had some very robust exchanges on that with Wicksteed, his arch-utilitarian enemy trying to insert for the first time an explicit functional distribution of income theory within early marginalism.

¹⁸ Dating back at least to Greek philosophers.

To put things even more bluntly, in modern parlance, the distribution of the agents' initial endowments has nothing to do with market mechanisms; it depends strictly and only on a pre-existing theory of 'distributive justice' and adequate institutional reforms in the distribution of wealth. To preserve this first type of justice, a working of the actual market mechanisms that leaves *unchanged* these initial endowments must be worked out. And, lo and behold, besides being efficient, the only market system which guarantees such a 'commutative justice' (i.e. justice in exchange) is a strictly atomistic competitive system; and pure economics is 'in essence the theory of the determination of prices under a hypothetical regime of perfectly free competition' (1954, p.). But Walras did not of course associate free competition with *laissez faire*. Walras's most peculiar policy prescriptions aim thus at turning 'real world' markets into competitive markets in order to guarantee both distributive and commutative justice. Hence, the reconciliation and synthesis between socialists and liberals would be complete. General equilibrium and pure economics are clearly defining the 'ideal' working of a market economy in which the principles of 'commutative justice' are upheld. An economic system working along these lines would be both just and efficient: the old man genuinely thought he had found the Rosetta stone of social sciences. The full divorce soon to be pronounced by Pareto between rational economic theory and a theory of justice was still completely foreign to old Walras. In modern parlance, and in some kind of pre-rawlsian fashion, the optimising characteristics of Walras's general equilibrium model are separate and dominated by a pre-existing theory of justice: *...j'estime... que s'il y avait antinomie entre l'intérêt et la justice, celle-ci devrait passer la première* (EES, p.196). Following Hobbes and Rousseau's social contract approach, with his natural law argument Walras suggests a transcendental theory of justice in order to define a 'just' distribution of initial endowments between agents. Having settled this first stage of his general argument, his attempt to define a distributionally neutral market structure will set him on building *ex nihilo* his general competitive equilibrium model. Justice in exchange would call for strong government interventions in the working of real world markets in order to bring them as close as possible to free competitive markets. Natural monopolies, consumers' imperfect information, public goods (such as security, justice, education, etc) and above all a regulation of the price level were calling for strict governmental policies¹⁹.

Distributive justice would also call for strong institutional and political reforms to alter the unequal distribution of wealth (or alternatively the unequal size of the agents' initial endowments). Based on a then already old-fashioned natural law theory of justice inherited from his father, Walras argued that i) individuals have a right to the produce of their own labour, and ii) that differences in wealth arising from differences in personal faculties are

¹⁹ In a book and various articles, the present author tried to connect the long and difficult analytical relationships between money and general equilibrium (clearly not yet solved today even by Kiyotaki and Wright or Kocherlakota) and, in particular to examine in detail Walras's desperate attempts at integrating monetary and price theories.

perfectly just. In other words, a redistributive system based on income tax would be unjust. The other source of wealth, land, being by rights (?) the property of all mankind, the government as the institution representing the communities has a right to land rents and hence to the property of the entire land. Taxation from income being an infringement on individual property (i.e. on unequally distributed human capital), the only just taxation is on land, or, more precisely on its revenue. Nationalisation of land, or the taxation of rents, would thus solve two problems linked to distributive justice. On the one hand, the unjust income tax system would be replaced by tax revenues based exclusively on land to which the state is 'naturally' entitled. On the other, the private property of land as the main source of inequality of 19th-century France would be eliminated.

II.2 A delicate balance between a normative and a positive approach

Historians of economic thought are in widespread agreement about general equilibrium theory as Walras's main technical contribution to economics. However, is there still room for disagreement over its interpretation: was it positive or normative in its aim? Or to what extent is this model 'a [positive] scientific description of the real world' [what 'real world'] and to what extent is it a 'normative' ideal fiction or, to use Jaffé's felicitous wording a 'rational utopia'? And this question is central to our research programme; and not only for Walras but for a century of intellectual development around the existence, the unicity and the stability of a general competitive equilibrium (and particularly, its connections with welfare economics and, ultimately, a theory of justice of e.g. a Rawlsian type). If a simple tool of analysis may be provisionally considered as 'neutral', the various 'uses' it is put to have to be carefully differentiated.

As is well known, as Walras's successor in the Lausanne chair, Pareto severed brutally all links between general equilibrium theory and any theory of justice. For the man of the optimum, Walras's old fashion attempt at keeping them linked was a sign of intellectual decay; and their divorce *the* way to turn economics into a genuinely scientific subject. In 1897, he went as far as to qualify Walras's laboured effort as 'economic metaphysics'! (see Bridel-Mornati, 2009). For nearly a century, the door was thus wide open to attempts at strictly non-normative interpretations of general equilibrium as an abstract and scientific description of the real world. In opposition to Walras, with the two fundamental theorems of welfare economics, most, if not all, Paretian economists from Hicks down to Samuelson and Varian struggled to dispense with all references to any utilitarian or idealist theory of justice. Based on the instrumental rationality of sovereign consumers, this tradition attempted to conceptualise a non-libertarian theory of justice exclusively linked with market mechanisms from which all links with agents were banned bar from their specific ability to order each their individual preferences. Without any preconditional agreement on the degree of justice

expressed by market mechanisms, relying exclusively on the principle of an equal liberty of choice, by construction, the market mechanism is considered as *the link par excellence* between individual preferences and social choices. In complete opposition to Walras's initial argument, the impartial competitive market mechanism is the (imperfect and failing) substitute for Smith's impartial spectator, Rousseau's general will or Kant's categorical imperative. In fact, for decades, mathematical general equilibrium was considered as the corner stone of *positive economics par excellence*; and their practitioners as the *élite* of the profession.

In the late 1970s, when, after a long and tortuous intellectual course, Jaffé became convinced that Walras's purpose had never been positive or descriptive but was normative and prescriptive in its very foundation, the positive interpretation of general equilibrium was going through the last phase of its dominant position; the relative slow-down experienced by this research programme since the mid-1980s had not yet started. The various, and sometimes violent, reactions, against Jaffé's interpretation were a good measure of its unsettling nature for a generation of economists and historians of economic thought raised mainly in a Hicksian-Samuelsonian version of general equilibrium; or, for a more sophisticated minority in its Arrow-Debreu axiomatic version.

Though editor of Jaffé's collected papers and the leading American Walrasian, Walker (one of Samuelson's students at MIT) waged a vigorous campaign (still on in his 1996 and 2006 books) against this cardinal sin against the Paretian-Friedmanite distinction between normative and positive economics. A few years later, Ingrao and Israel 'totally disagree[d] with this view' because, according to these authors, 'Jaffé overlooks ... the very close relationship between scientific abstraction and empirical evidence Walras intends to maintain' ([1987], 1990, p. 387). In a different way, and amongst other examples, Roger Backhouse adopts a similar position:

The problem with both these interpretations is that they separate the positive and normative aspects of Walras's system, whereas both were important, for both were crucial to the schemes of social reform to which he attached so much importance.... For if the world was not described, at least approximately, by the competitive model, Walras would have no basis for... his schemes of social reform ... and his view of social justice (1985, p. 84).

Among the few immediate converts to Jaffé's position, Mark Blaug, 'on due reflection... came to the view that Jaffé was right and that everybody else has been wrong' (1984, p. 481).

Clearly the delicate balance of these two aspects remain an open question in general equilibrium theory and not only in Walras's own work. But Walras was clearly more aware than all his modern interpreters and model-users of the need for a synthesis.

In order to understand better the subtle connection between normative and positive aspects of the Walrasian system of general equilibrium, and in order to figure out if lessons could be drawn for today, I turn now to some recent research conducted on Walras's own philosophical

and epistemological background explicitly used to articulate his overall model. The delicate balance mentioned earlier should eventually tipped in favour of Jaffé's approach.

III. Walras, Vacherot and methodology

In the very first section of his *Eléments*, Walras asserts that pure economics is a 'physico-mathematical science like mechanics' and that its method is 'mathematical or rational'. Mathematical techniques and instruments can be applied as a matter of fact to economics because 'the fact of the theory of value in exchange is really a branch of mathematics' (Walras, [1874], 1954, p. 70).

However, the 'mathematical method is not an *experimental* method; it is a *rational* method' (id. p. 71): starting from 'real types' borrowed from experience, this method defines 'ideal types'; and, on the basis of these definitions and by (mathematical) deductions, 'mathematical economists construct *a priori* the whole framework of their theorems and proofs' (id. p. 71); and the resulting mathematical model is *not* in need of any empirical confirmation/verification. In other terms, and in Walras's own words, this procedure amounts to '*faire du rationnel avec de l'expérimental*' ie. 'to turn experimental facts into a rational model'.

Induced from 'real types' borrowed from 'real world experiences', ideal types are thus theoretical concepts on which the theorist can apply mathematical formalisation. Mathematical analysis allows then the formulation of 'facts, ratios, laws', which rule and explain (in the field of pure economics) the mechanism of price formation. However, and in order not to fall into a purely fictional representation of the real world, Walras allows some room for practical experience. In this particular sense, all scientific knowledge is, for him, positive: but, it is based on a *possible* experience. While it is true that theoretical models disconnected from observation and experience are bound to be empty, shallow and presumably false, Walras is no less convinced that reality and observation serve only as a first step (or a stepping-stone) on which to erect a rational abstraction. Once again, he is treading a difficult path between pure idealism (illustrated by the 'socialists') and a crass realism (attributed to the market 'liberals'). Hence Walras's strange mixture Jaffé aptly nicknamed a 'realistic utopia'. It is within this strange mixture – a by-product of the French mid-nineteenth century intellectual controversies- that one has to try to understand the normative nature of Walras's general equilibrium theory (and not within the standard Robinsonian normative/positive distinction which still riddles today most of mainstream economics).

In his autobiography, Walras mentions the powerful influence of two books on his intellectual development: Poincaré's textbook *Elements of Static* and Vacherot's *Métaphysique et la science* (1858). The first is the textbook in pure mechanics used at the time at the Ecole

polytechnique: straight out of its chapter 2 –‘The equilibrium conditions between opposing forces expressed in equations’– comes his general equilibrium dreary algebra. The second is of greater interest to us here since it is Walras’s nearly exclusive source of inspiration in the realm of philosophy of science²⁰. In fact, the philosophy of science Walras built himself on Vacherot’s utterances is fully developed in his 1868 *General Theory of Society-The Social Ideal* written before he turned to economics proper. Walras always considered this text as fundamental and, under Pareto’s sarcasms, gave it a second edition as late as 1896.

In this volume, Walras takes over Vacherot’s definition of science as belonging ‘to the realm of ideals and absolutes’; or, even more clearly, as an ‘idealisation of reality’ as opposed to ‘the realm of reality necessarily imperfect’ (1868, p. XXXI). This hypothesis is suggested however under the proposition that ‘in social sciences as well as in pure geometry, ideas or admissible ideals are to be grounded on the understanding of real types offered by experience’ (1868, p. XIX).

In opposition to Vacherot (and anticipating somewhat the classical Weberian distinction), Walras adds to the opposition real-ideal the term ‘type’. Again, ideal types constituting an ideal science are drawn from real types reachable by experience. Empirically based, but without being purely fictitious, science is thus the expression of an ideal. Hence science belongs to an ideal domain of perfection which cannot be found in an ‘imperfect reality’.

Hence, for Walras, and this is crucial, pure theory cannot be empirically confirmed or refuted. In the margin of his own copy of Cournot’s *Mathematical Researches*, Walras takes Cournot’s verificationist approach to tasks when he writes: ‘pure theory does not expect any confirmation from reality’. The abstract and ideal nature of pure theory makes useless any verificationist attempt to confront it to reality. Isn’t such a statement a truism according to which any abstract model is only an approximation of some ‘real world’? And that the value of such an approximation could be statistically estimated by a measure of its standard error? (an argument used for example by Arrow and Hahn in their 1971 *General Competitive Equilibrium*). A careful reading of both Vacherot and Walras eventually convinced us of the opposite. When Walras repeatedly asserts that pure theory cannot be ‘verified’, he does not make a statement on some sort provisional difficulties linked for example to temporary statistical difficulties. He does not either limit his argument by claiming the legitimate right of a theorist not to be submitted to such a test. No. For better or worse, his is a much more powerful argument. For him, verificationism²¹ is not an option because of the very nature of knowledge and its necessary divorce from contingent facts.

However, realism, in the philosophical sense of the word, is a component of both Vacherot and Walras’s thought. And, curiously, we are sent straight back to the problem of the

²⁰ Vacherot is a second-rate sub-Kantian French philosopher hardly read at the time and, today, completely forgotten; the exploration of Vacherot’s work has been one of the most excruciating experiences of this research; but was necessary since Walras is sometimes using word for word the gospel of his philosophical mentor!

²¹ *A la* dynamic stochastic general equilibrium... ?

universals of medieval philosophy. Despite Kant's definitive critique, Vacherot re-asserts a theory of the ontological value of knowledge: order, relation, proportion and ultimately scientific laws are *within* the objects themselves. As a philosophical realist, Walras can thus strongly assert that the features e.g. of a competitive equilibrium exist prior and *independently* of the particular market forms that can be found in the real world. Moreover, for him the human mind may get to know the object of the inquiry without altering its nature. The mind may thus get behind the crude representation of these objects of the inquiry in order to understand no less than their *essence*.

Walras's realism (borrowed from Vacherot) postulates thus that the laws governing facts exist prior to the facts themselves (*universalia ante rem*) and that these laws exist independently of the human mind. Ideal types and their laws of interdependence deductively discovered with the help of the mathematical method are true in the sense of an ontological truth. And pure economics is a field particularly well suited to such a method of inquiry.

Hence, for Walras, if the foundation of any scientific knowledge is in the experience (otherwise the scientist would invent a pure fiction), by abstraction, pure theory formulates an ideal. This essence of phenomena may be hidden under the weight of the multitude of 'observed facts'; but the very object of scientific research is to discover its existence. Indeed, the whole issue is to give some meaning to the word 'existence'. In the contingent world, ideal types exist in an uncompleted and unfinished way; but, for Walras, human kind's slow progress from the initial chaos towards perfection is simply the path along which ideal types are progressively replacing inadequate real types²².

The theory of *tâtonnement* (or stability analysis) appears to be a well-chosen theme to test the exact ambitions of Walras's *Eléments*, and in particular, its alleged 'realism'. In order to illustrate this line of argument, I turn briefly now to this age-old debate illustrating very nicely Walras's method of moulding reality into an ideal fiction of commutative justice subject to the economic efficiency of the market. Starting with a price-equilibrium mechanism apparently close to the real type of the Paris stock exchange, four editions later, and in deference to his twin principles of justice, Walras will have turned his *tâtonnement* process into a mere mathematical algorithm (of the Gauss-Seidel type), which, he nevertheless kept claiming, was an ideal towards which real-market adjustment processes should tend.

²² It might be worth mentioning here that, this oldest of all philosophical debates also interested Walras's successor. As a matter of fact, Pareto, adopts a diametrically opposed position. In a letter to Pantaleoni, he dubs himself 'a nominalist among the nominalists'... While, refining Walras's general equilibrium instrument, Pareto always argued that the scientist can only reach a very imperfect understanding of economic phenomena. Accordingly, general equilibrium is only for him a 'first approximation' of an infinitely complicated reality the understanding of which the scientist will only approach but never reach – let alone understand the essence! Theoretical uniformities or general notions like a competitive equilibrium are deduced from the facts that they endeavour to organise (*universalia post rem*). Theories are only relative; only facts are truly important.

IV. Tâtonnement and the search for a distributional neutrality of the market mechanism

The theory of *tâtonnement* is undoubtedly at the centre of one of the most debated and controversial topics in Walras's as well as in modern general equilibrium theory. Already fiercely criticised by Bertrand and Edgeworth in the 1880's, this key component of Walras's model lived a highly controversial life in the hands of many prestigious theorists down to Sonnenschein (1972), Mantel (1974) and Debreu's (1974) seminal (but negative) results. Similarly, in the usually more sedate world of historians of thought, the status of the successive versions of Walras's own *tâtonnement* mechanism has been the subject of sometimes heated but mostly inconclusive discussions²³.

As an idealised competitive mechanism, the theory of *tâtonnement* is largely constrained by the necessity to prove the convergence of this mechanism towards a *unique* general equilibrium position. Such an objective is closely linked with the absolute necessity faced by Walras to include in his theory of exchange a 'mode of motion' towards equilibrium, but also the unequivocal requirement faced by this theory of *tâtonnement* to prohibit any *hysteresis* effect²⁴. In particular, and in order to comply with Walras's commutative justice, distributional (or income) effects endogenous to the *tâtonnement* mechanism are excluded. Such a mechanism in theoretical time can certainly not be viewed as a 'realistic' link between Walras's pure and applied economics. At this stage, given the technical difficulties and within the confine of this essay, only very general remarks are possible (see however Bridel & Huck, 2002; Donzelli, 2006; Bridel, 2008).

As early as 1874, Walras demonstrates formally that, within his pure exchange model, the distribution of wealth is one of the parameters of his general equilibrium system (in fact the very aim pursued to uphold his principle of commutative justice). He is also fully aware of the hysteresis effects brought about by the distributional consequences endogenous to the *tâtonnement* mechanism. Hence, in his second edition, Walras is led to elucidate this *tâtonnement* model: on the one hand, the no-trade-out-of-equilibrium rule is formally introduced in his pure theory of exchange; on the other, the assumptions behind the workings of the *tâtonnement* mechanism are re-stated in order to include *ex definitio* the necessary distributional neutrality of the *tâtonnement* in the theory of production. Moreover, Edgeworth's frontal assault against the very feasibility of any realistic 'mode of convergence' towards general equilibrium strengthens Walras's determination to complete his construction

²³ Even Jaffé altered radically his views on *tâtonnement* between his 1967 and 1981 articles. Together with Walker's 1972 and 1987 contributions, they form the bulk of the output published on Walras's theory of *tâtonnement*.

²⁴ "A term used [...] to describe the circumstance in which the equilibrium of a system depends on the history of that system" (Pearce, 1996, p. 190).

of a *tâtonnement* mechanism in his theory of production²⁵. Hence, the convergence of *tâtonnement* and its distributional neutrality are fundamental parts of pure economics as well as, more generally, of the grand “Walrasian design”.

On the one hand, and most importantly, the internal coherence of the *Eléments* is here at stake. The various attempts at suppressing the distributional effects of disequilibrium transactions in production theory in the first three editions end up in failures. Introduced in the fourth edition, the *tâtonnement sur bons* on the capital market (the so-called written pledges) will eventually succeed in formalising a *tâtonnement* mechanism truly neutral. Since all sources of price variations are rejected *ex definitio* in the discussion of the law of establishment of prices, such a theoretical illustration of the competitive mechanism is, *per se*, highly contentious. But the *tâtonnement sur bons* alone can ensure the internal coherence of the Walrasian argument. As a matter of fact, the assumptions behind the working of the *tâtonnement* mechanism are at last compatible with a convergence demonstration in which the supply functions of services and demand functions for goods are constant.

According to Walker’s opinion about Walras’s ‘phases of theoretical activity’, “the decline of Walras abilities is evidenced by his introduction of a written pledges [*tâtonnement sur bons*] model that is [...] incomplete and sketchy” (1996, p. 12). The model of editions 2 and 3 is supposed to fulfil realistic aims endowing it with theoretical features far superior to the *tâtonnement sur bons*. However, in the *Eléments*, Walras’s epistemology is not ‘realist’. In essence, Walras does not endeavour to describe the working of a capitalist economy akin to the contingent reality beyond his windows. It is of course possible to argue that Walras is a ‘realist’ but only in the sense of a philosophical realism characterised by an attempt to understand the *essence* of reality. At the very beginning of the *Eléments*, Walras insists for example on the difference between the stock market –a ‘real type’– and the *tâtonnement* model which is an ‘ideal type’ (1954, §44 and §48, pp. 86-88 and 90-91). In 1898, he reaffirms this argument with vigour: “I have explained [...] that, in order to build the theory of the determination of current prices [...], I took for granted an equilibrium established *ab ovo* [...] and a hypothetical market on which *tâtonnement* could be conducted until the establishment of equilibrium” (1898, p. 307; emphasis added). Hence, even if Walras keeps repeating that the “theoretical solution” is reached in an “empirical” manner, the theoretical argument he provides is only valid for a timeless economy working “under a hypothetical régime of perfectly free competition” (editions 2-5 as in 1954, p. 40).

25 «[Walras] describes a way rather than the way by which economic equilibrium is reached. For we have no dynamical theory determining the path of the economic system from any point assigned at random to a position of equilibrium. We only know the statical properties of the position [...]. Walras’s laboured description of prices set up or ‘cried’ in the market is calculated to divert attention from a sort of higgling which may be regarded as more fundamental than his conception [of *tâtonnement*], the process of recontract [...]. It is believed to be a more elementary manifestation of the propensity to truck than even the effort to buy in the cheapest and sell in the dearest. The proposition that there is only one price in a perfect market may be regarded as deducible from the more axiomatic principle of recontract » (1925, II, pp. 311-12).

On the other, the convergence of the *tâtonnement* mechanism towards a *unique* general equilibrium constitutes one of the most central components of pure economics. As early as 1877, Walras considers that this problem is a “key point” (1883, p. 307) and the “heart of the question” (1883, p. 308) in his theory of prices.

In essence, the *tâtonnement* mechanism is after all the ‘ideal type’ theoretical representation of the competitive mechanism. As far as a theory of exchange deprived of a mode of motion towards equilibrium is tantamount to only half a theory of exchange, it is most crucial for Walras to demonstrate rigorously the convergence of the *tâtonnement* towards general equilibrium. Moreover, such an achievement would also allow Walras to characterise competition with the same conditions than general equilibrium: maximum satisfaction of wants under the budget constraint with free utilisation of resources; unicity of price determined by the equality between aggregate supply and demand; equality between supply price and cost of production for each and every good. Thus, in the pure theories of exchange and production, and after having defined the general equilibrium conditions and established the convergence of the *tâtonnement* mechanism towards this set of equilibrium prices, Walras is eventually in a position to provide his general and analytical definition of free competition. The first version established in the simple case of two goods exchanged between an indefinite number of holders ‘simply’ “embraces [for him] the whole of pure and applied economics” (1954, p. 143). In the more general production case, his definition includes explicitly the conditions of *libre concurrence absolue* so crucial to Walras’s social economics:

Production in a market ruled by free competition is an operation by which services can be combined and converted into products of such a nature and in such quantities as will give the greatest possible satisfaction of wants within the limits of the double condition, that each service and each product have only one price in the market, namely the price at which the quantity supplied equals the quantity demanded, and that the selling price of the products be equal to the cost of the services employed in making them (1954, p. 255).

In his early pre-analytical “theory of property”, Walras assesses these conditions of “perfectly free competition” stated in this analytical definition of free competition and concludes to the “justice in the competitive exchange”. This demonstration constitutes for him “the heart of the scientific theory of property” (1896 as in OEC, IX, p. 179). The ‘justice in exchange’ is precisely characterised by the fact that, like Jevons’s equation, the competitive exchange “leaves unchanged the inequality of wealth” (1896 as in OEC, IX, p. 179-180). The distributional neutrality of competition (and, in particular, of *tâtonnement*) plays thus a central normative part in the Walrasian theories of property and of justice: as a matter of fact, the very notion of ‘justice in exchange’ finds eventually its analytical and formal content in the *Eléments*. Eventually, the distributional neutrality of free competition forms one of the bridges linking pure economics with social economics²⁶.

²⁶ Walras had of course a pure exchange economy in mind. Anticipating the 1970s literature linked to the absence of envy and the equal distribution of initial endowments (in particular Varian, 1974), Walras was fully aware of the difficulties of transposing his argument in a production economy (hence his *tâtonnement sur bons*).

In a nutshell i) from the very first 1874 edition of the *Eléments*, Walras could not ignore the impact of endogenous distribution effects on the *tâtonnement*, ii) in opposition to Edgeworth's theory of exchange (based on an utilitarian pleasure machine), the convergence of *tâtonnement* towards equilibrium prices is an integral part of Walras's market machine, and iii) the successive alterations and refinements brought by Walras to his *tâtonnement* mechanism throughout the various editions of his magnum opus are determined by the necessity to eradicate any source of path dependency. The internal coherence of Walras's model is eventually shown to win clearly over any pretence of 'realism'²⁷ in order to save his crucial normative 'justice in exchange'.

The part played by *tâtonnement* in Walras's theory of exchange as an algorithmic – and not realistic – mechanism and the necessary absence of distributional effects in his theories of exchange and production are hence central characteristics of the 'justice in exchange' which, in Walras's 'Theory of Property', is nothing but one of the leading arguments behind his solution to the 'question sociale'. Hence, the 'distributional neutrality' of *tâtonnement* appears to be one of the characteristic and crucial elements linking Walrasian pure and social economics²⁸, i.e. his pure economic theory with his theory of justice. As expected, as his successor in the Lausanne chair, Pareto naturally hastened to express ironic amusement at what he called Walras's 'empty ideological chattering?.'

V. Conclusion: Walras's general equilibrium system as a normative component of a general theory for a just and efficient society

Walras is still well within the Smithian tradition. He has not yet pronounced a full divorce between rational economic theory and a theory of justice; however, he has already clearly decided to keep one constant while discussing the other. To summarise briefly a very complex argument, Walras's 'immanent' theory of distributive justice is based on what he calls the 'bon vieux droit naturel'. The solution to the question of a 'fair distribution of income' pre-exists thus his theory of exchange, which, in turn, has to be neutral on this 'just' distribution of initial endowments. In other words, the distributional justice is solved outside the mechanism of exchange and, thanks to the analytical condition of free competition, the pure theory of exchange outlines the requirements necessary to uphold a commutative justice. The

²⁷ 'Realism' is understood here as an attempt at describing some sort of contingent 'real' world.

²⁸ See Jaffé (1980) and Huck (1999).

neutrality of exchange on the initial distribution of income (commutative justice) is a necessary requirement to uphold Walras's theory of distributive justice. And the progressive hardening of the *formal tâtonnement* mechanism into a sheer mathematical algorithm is a necessary outcome of his justice in exchange. With these two halves of his overall schemes, with a rational economic theory and a theory of justice, Walras had the intention to reconcile socialism with liberalism. In Walras's anti-utilitarian rational utopia a coalition between *libre concurrence absolue* and political equality was still thought possible. With Pareto, the arch-rational general equilibrium model broke from any social philosophy and acquired a life of its own in the hands of mathematical economists. Human being's rich plurality of motivations with which Smith, Condorcet and may be Walras tried desperately to grapple disappeared for a long time from the horizon of most theoretical economists.

Bibliography

To be completed

General equilibrium puts together consumer choice and producer theory to find sets of prices that clear many markets. It was pioneered by Kenneth Arrow, Gerard Debreu, and Lionel Mackenzie in the late 1950s. Many economists consider general equilibrium to be the pinnacle of economic analysis. General equilibrium has many practical applications. For example, a study of the impact of carbon taxes uses general equilibrium to assess the effects on various sectors of the economy.

14.1 Edgeworth Box. Learning Objectives.

In economics, general equilibrium theory attempts to explain the behavior of supply, demand, and prices in a whole economy with several or many interacting markets, by seeking to prove that the interaction of demand and supply will result in an overall general equilibrium. General equilibrium theory contrasts to the theory of partial equilibrium, which only analyzes single markets. In general equilibrium, constant influences are considered to be noneconomic, therefore, resulting beyond the natural General equilibrium theory, or Walrasian general equilibrium, attempts to explain the functioning of the macroeconomy as a whole, rather than as collections of individual market phenomena. The theory was first developed by the French economist Leon Walras in the late 19th century. It stands in contrast with partial equilibrium theory, or Marshallian partial equilibrium, which only analyzes specific markets or sectors.

Key Takeaways.

General equilibrium analyzes the economy as a whole, rather than analyzing single markets like with partial equilibrium analysis. General equilibrium shows how supply and demand relationships that arise between markets' participants and elements while describing it. This model is based on the analysis of supply and demand. At such markets all prices are variable and equilibrium requires that all markets clear, considering both positive and normative properties of general equilibrium as well. We are also about to investigate the relationship between the competitive equilibrium and Pareto efficiency and to study fundamental theorems of welfare economics and its meaning for the economics in context of general equilibrium analysis.

Part I. General Equilibrium in a Pure Exchange Economy.

1.1. Positive Analysis.

1.1.1 Pure Exchange Economy.

General Equilibrium Theory studies the properties and operation of free market economies. The field is a response to a series of questions originally outlined by Leon Walras about the operation of markets and posed by Frank Hahn in the following way: "Does the pursuit of private interest, through a system of interconnected deregulated markets, lead not to chaos but to coherence - and if so, how is that achieved?" This is always an apt question, but particularly so given the "Global Financial Crisis" that emerged from the operation of market economies in the Americas and Europe in mid to late 2000s.

In economics, general equilibrium theory attempts to explain the behavior of supply, demand, and prices in a whole economy with several or many interacting markets, by seeking to prove that the interaction of demand and supply will result in an overall general equilibrium. General equilibrium theory contrasts to the theory of partial equilibrium, which only analyzes single markets. In general equilibrium, constant influences are considered to be noneconomic, therefore, resulting beyond the natural General-equilibrium analysis studies equilibrium in all markets simultaneously. 7 / 61. General Equilibrium. Partial equilibrium analysis can lead to bias. Consider the market for DVDs and cinema tickets. The government taxes movie tickets. If we look at partial equilibrium, the supply curve for movie tickets shifts and we are done. If we look at general equilibrium, we consider how this might affect the DVD market (which feed back into the movie ticket market). 8 / 61. General Equilibrium. A leftward shift in the supply for cinema tickets will increase the price of cinema tickets. This will in... Both people want to be further from their origin. 18 / 61. Trading Between Two People. As against partial equilibrium analysis, general equilibrium analysis is concerned with economic system as a whole. It recognises the fact that economic system is a network in which all the parts are mutually dependent on one another and in mutual interaction with one another. Therefore, change in the demand or supply of any commodity or factor of production sets in motion a chain reaction. A disturbance in one sector of the economy produces its repercussions on all sides. General equilibrium analysis is concerned with the overall effects of a disturbance. Instead of taking only a few variables at a time, we take into consideration all the relevant variables which may affect the particular phenomenon in hand. General equilibrium analysis is a theoretical structure which focuses re-search in economics. On this point economists and philosophers agree. Yet studies in general equilibrium analyses are not well understood in the sense that, though their importance is recognized, their role in the growth of economic knowledge is a subject of some controversy. Several questions organize an appraisal of general equilibrium analysis. These questions have been variously posed by philosophers of science, economic methodologists, and historians of economic thought. Is general equilibrium analysis a theory1, a