

## Chapter 18

# Léon Walras: What Cutes Know and What They Should Know

J.A. Hans Maks and Jan van Daal

The general idea among contemporary university-trained economists (“cutes”) of what Léon Walras (1834–1910) has contributed to analytical economics may be summarised in modern notation as follows: Let a system of equations be given:  $\mathbf{e}(\mathbf{p})=\mathbf{0}$ , where the symbol  $\mathbf{p}$  denotes an  $n$ -dimensional vector of prices of goods brought to the market and  $\mathbf{e}$  is a vector-valued function of the prices representing the  $n$  excess demands in the market for the goods. The equation expresses market equilibrium and the generally accepted view seems to be that there is a so-called auctioneer who takes care that such an equilibrium will occur. To that end, he, the auctioneer, announces an initial vector  $\mathbf{p}'$  of prices. The people who bring the goods to the market in order to exchange (part of) them for other goods react on these initial prices by establishing certain quantities of goods demanded or supplied. The auctioneer aggregates all this into a vector  $\mathbf{e}(\mathbf{p}')$  of excess demands. If this vector of excess demands is not a vector of zeroes only, then no trading takes place and the auctioneer announces another price vector  $\mathbf{p}''$  by increasing somehow in  $\mathbf{p}'$  all prices of goods with a positive excess demand and by decreasing those with a negative excess demand. The function  $\mathbf{e}$  has such properties that the new excess demand  $\mathbf{e}(\mathbf{p}'')$  will be closer to zero than  $\mathbf{e}(\mathbf{p}')$ . If there would not yet be equilibrium at prices  $\mathbf{p}''$ , the auctioneer announces other price vectors  $\mathbf{p}'''$ ,  $\mathbf{p}^{iv}$ , ..., until eventually a vector  $\mathbf{p}^*$  is obtained with  $\mathbf{e}(\mathbf{p}^*)=\mathbf{0}$ . Then trade will take place, at prices  $\mathbf{p}^*$ . The process of groping from the arbitrary initial price vector  $\mathbf{p}'$  to the equilibrium vector  $\mathbf{p}^*$  is known as Walras’s tâtonnement process. Below we shall see that there is much more to say on tâtonnement. Let us already now point out that Léon Walras himself never made use of the fiction auctioneer.

All standard mainstream textbooks deal with the essence of this system; sometimes, a word on production in Walras’s work is added. The standard general perception is

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J.A.H. Maks (✉)

School of Business and Economics, Department of Economics, Maastricht University,  
P.O. Box 616, 6200 MD Maastricht, The Netherlands  
e-mail: h.maks@maastrichtuniversity.nl

that he ignores, among other things, capital, savings and money and that any allusion to dynamics is lacking. A possible explanation for this situation might be the publication, in the fifties of the last century, of Gerard Debreu's *Theory of Value* (1959). In this influential book, and in preceding articles, general conditions for the existence of a (unique) general economic equilibrium are presented in an elegant and modern mathematical way. In fact, however, *Theory of Value* is restricted to a model with exchange and production only. Since then, textbooks confine themselves mainly to reproduce general economic equilibrium theory more or less rigorously in this narrow setting. In the last decades, however, there is a growing awareness that Walras contributed much more than is generally recognised and that the problems he was concerned with are still vital issues for contemporary economists. In this paper, we want to substantiate this.

In the next section, a short sketch of Walras's life will be presented. This small biography already makes the indefensibility of the above narrow view apparent. Then outlines of his various contributions to the several domains of economic science follow: pure economics (§§ 3–7) and applied and social economics (§§ 8–11). Some secondary literature on Walras will pass the review in § 12. We end with a few concluding remarks (§ 13).

## Some Biographic and Bibliographic Facts

Léon Walras was born in 1834 in Évreux (Normandy).<sup>1</sup> In about 1854, he went to Paris where he became a student at the *École des Mines*. Largely due to his father's influence, he was greatly interested in what was called the "Social Question", that is the misery of the poor, and the problem of how to alleviate their situation. This and his Bohemian temperament made him hardly fit for the mining business. The consequence was that he was a student only in name. It seems that as such he did not produce any papers. Instead, he felt a calling to become a man of letters. He thought this was the best way to put himself at the service of the Social Question. Indeed, by 1858 he had written a novel, entitled *Francis Sauveur* (with a long introduction on the Social Question), a short story and much more prose expressing his social ideas. The reaction of the public outside Walras's own circle was not, to put it mildly, encouraging, so that making a living out of these activities did not seem to be very hopeful.

The reaction of his father, the economist Antoine-Auguste Walras (1801–1866), an able literary man himself, was severe, but not altogether negative. On the one hand, Auguste judged his son unfit for literature: Léon should not go on. Accordingly, he stopped paying for his son's university training. On the other hand, however, he

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<sup>1</sup> Walras's great-grandfather was born in Arcen in the Southern part of The Netherlands, under the name Andraeas Walravens and migrated to the South of France. His son became a kind of lower magistrate in the city of Montpellier. In between, the name was shortened into Walras. Because of the Dutch origin of the name, the s in Walras has to be pronounced (see Walras 1965, Letter 999).

respected Léon's aspiration to contribute to the solution of the Social Question. Therefore, he suggested that his son should set up a career as a publicist on economic matters. With his father's help, Léon found a job as a kind of junior editor of the *Journal des économistes*. Furthermore, and that was most substantial, Auguste put his library and his vast collection of unpublished writings at his son's disposal, after which the two started a comprehensive and broad correspondence on economic matters. This provided Léon with a large number of subjects and ideas.

For Léon Walras, twelve hard, laborious and studious years in Paris followed. From the very beginning, he was a prolific writer and moreover, he was active on many other fronts. During this period, he wrote more than 80 books, articles, brochures and other papers altogether (Walker 1987b). Nevertheless, it was difficult to earn a living. His employers were not always happy with the ideas expressed in his writings and so he was often obliged to look for another occupation. There were several failures and only a few successes. One of these successes, however, was decisive for the rest of his career. In 1860, he participated in a conference on taxation in Lausanne, where he attracted some attention. There he encountered a young Swiss lawyer, Louis Ruchonnet. They became friends and met several times afterwards. Ruchonnet's career developed successfully and by 1870, he had risen to the function of chief of the department of education of the Swiss Canton Vaud. In that quality, he was responsible for the reorganisation of the Académie de Lausanne and this led him to suggest that Léon Walras should apply for the new professorship of economics. Indeed, Walras was nominated, although he had no academic degrees and in spite of the fact that he did not make a secret of his interest in the Social Question, which made him simply a socialist in many people's eyes but not in his own. The run up to the professorship was, therefore, not a walkover. Three of the seven members of the Nomination Committee eventually considered his allegedly socialist ideas as insurmountable for the function. Some of the other members hesitated, too. Consequently, he was in first instance nominated for 1 year only, with the lowest possible majority of the committee. On December 16th, 1870, his 36th birthday, he started his lectures in Lausanne. Ruchonnet, however, stood squarely behind Walras. To people who know the working of the university system, then and now, it was therefore not very surprising that 1 year later Walras obtained his tenure. He lectured until 1892; then he retired because of serious health problems. He continued his research until about 1900 and died in 1910.

Léon Walras was a dutiful lecturer. He wrote out all his lessons in full (see Walras 1996). His oral presentation, however, does not seem to have been brilliant, to say the least. His political ideas did not gain him distinction, either. It is his research that has made him famous, especially on general economic equilibrium, as we shall see below. It should not be forgotten that the Social Question was thereby the leitmotiv.

Auguste Walras's main message to his son was that if one wants to raise people, and in particular those in misery, to more favourable conditions, then one must first study their economic circumstances. Léon apparently believed it was necessary, to devise a theoretical economic framework in which each person, or at least each family, is considered an individual entity because the happiness of every person counts. Walras did so in his pure theory. This part of his research is well known and his fame

rests on it. It is set out in his *Éléments d'économie politique pure, ou théorie de la richesse sociale* (first edition, in two instalments, 1874–1877). In the *Éléments*, he presented his theory of the utility maximising consumer and that of general economic equilibrium under the regime of free competition, the former being the ferment to the latter. The book was to be the basis for his further work on applied and social economics. Walras's intention was to deal with these two topics in two other broad, systematic treatises.

As so many first-generation academic economists, Walras felt (and indeed was) obliged to provide an overall picture of the whole field. Starting with pure theory, however, he ran out of time (and his health deteriorated). So he did not succeed in completing the other treatises envisaged. Instead, he consolidated the bulk of his other research in two volumes, entitled *Études d'économie sociale* (Walras 1896) and *Études d'économie politique appliquée* (1898). Both volumes consist of papers already existing. In this form, they could not compete with the *Éléments d'économie politique pure* and, therefore, the latter book received more attention. The four editions of the *Éléments* and the two *Études* contain the essence of Walras's work.<sup>2</sup>

## Free Competition and Laisser Faire

For Léon Walras, the basic economic phenomenon was exchange of scarce, useful goods between freely competing parties. Therefore, he saw as his basic task the explanation of ratios of exchange, i.e. prices. Consequently, neither the Robinson Crusoe economy, nor the two-goods-two-exchangers economy was an appropriate starting point for his analysis. His assumption of free competition may look, indeed, more reasonable if each good or service would be offered and demanded by at least two persons, in other words, a group. Free competition means, according to Walras, that demanders and suppliers of goods and services are free to engage in processes of higgling and haggling in the markets, which will equalise supply and demand of these goods and services, and that entrepreneurs are free to enter into or withdraw from all branches of industry to seek benefits or to evade losses. All these activities take place simultaneously and influence each other. Free competition, Walras says, is a self-regulating mechanism that brings about equilibrium in the markets at unique prices per good or service, and equality of selling prices to cost prices in all the branches of industry. Walras was interested, as we shall see, both in the final result of free competition, i.e. the equilibrium situation, and the process of bringing about

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<sup>2</sup> After the first edition of the *Éléments*, three revised editions followed, in 1889, 1896 and 1900. Walras did not live to see in print the revisions he made after the fourth edition. These appeared in the posthumous, fifth edition of 1926. An English translation, by William Jaffé, of the latter edition appeared in 1954. From 1987 onwards, the "Centre Auguste et Léon Walras", Lyon, republished (with Economica, Paris) Léon Walras's complete works in nine volumes as part of the fourteen volumes of *AUGUSTE AND LÉON WALRAS, ŒUVRES ÉCONOMIQUES COMPLÈTES*, completed in 2005. See also the Walras bibliography in Walker 1987, where 239 titles are mentioned.

this equilibrium, i.e. what actually happens in the markets. Furthermore, he wanted to be able to study these two aspects of free competition separately.

The question rises: “Was Léon Walras a partisan of unlimited free competition?” The answer should be “No, absolutely not!” At the very first page of his very first analytical publication on the subject (a paper presented at a meeting of Parisian colleagues in 1873), Walras makes his position clear (see Walras 1874a, b, 1987: 262). He wants to study theoretically the phenomena of production and exchange of goods and services “under the regime of the most free competition, the most absolute *laisser faire, laisser passer*, abstraction made from any consideration of interest or justice”. However, he continues: “I am absolutely not saying [that I am doing this] because free competition would be more useful or more equitable, but I only want to know what would happen”.

*Laisser faire, laisser passer*, i.e. free competition under all circumstances, was the order of the day among “les économistes” at that time, whereas the “socialists” abhorred it. Both groups restricted themselves to slogan mongering, instead of underpinning their opinions with sound arguments. Here, Walras saw a task. He compared himself with a medical researcher who tries to learn everything about a certain drug, not because he wants it to be used under all circumstances, but in order to know, as a doctor, when to prescribe it and when not.<sup>3</sup> Therefore, Walras set out to find conditions for and consequences of free competition. This became the core of his pure theory. However, he was quite aware of the existence of alternatives and of the need to study their effects. Below, we shall sketch his analysis of monopoly and his remedy of its unwanted effects. But now we will turn to Walras’ analysis of general economic equilibrium in a period.

## General Economic Equilibrium in a Period: Temporary Equilibrium

To make things more comprehensible, Walras stylised the economic process as a sequence of periods of time where production and trade per period take place determined by the working of a carefully devised mathematical model. Walras wrote, as it were, a spectacle of economic activities approaching a situation of free competition as

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<sup>3</sup> Walras expressed it as follows in a letter to W. Lexis du 17 mars 1883 (Walras 1965, letter 548):

(...) il m’a semblé que vous me considérez comme un partisan de la libre concurrence absolue (en raison de ce fait que j’étudie très attentivement et très minutieusement les effets de la libre concurrence). Quoi qu’il en soit, je tiens à vous faire savoir que, tout au contraire, c’est plutôt le désir de repousser les applications mal fondées et inintelligibles de la libre concurrence, faites par des économistes orthodoxes qui m’a conduit à l’étude de la libre concurrence en matière d’échange et de production. Un médecin qui aurait analysé dans le dernier détail les effets physiologiques d’une substance serait à la fois, par ce fait, très partisan de son emploi dans certains cas et très opposé à cet emploi dans certains autres cas. Telle est ma position (...).

accurately as possible. He did this for two reasons. First, he hoped to gain more insight into the working of the economic world of his time. Second, he hoped to obtain a theoretical basis for social reform. The analogy with a play or, if one wishes so, a drama, goes further. The “acts” are the periods and they consist of various scenes, as we shall see. The accessories, i.e. the stage properties, are the goods and services and their prices, including wages and the rate of interest. The actors are the people in the roles of consumers with their preferences of the period in question, producers with the technology of that period, capitalists with the stocks of that period and entrepreneurs.

At the outset of the period under consideration, both individual quantities of capital and the parameters of the model are given: technology in the form of the production coefficients and preferences of the consumers in the form of utility functions. Moreover, the composition and size of the population are considered as given. All these data are assumed to remain fixed during the period. Then the “play” starts with the first “act”, i.e. the first period. There will be a break at its end, when the concerning period’s equilibrium is reached. Endogenously determined quantities of newly constructed capital goods result to be used in the next period. Together with what remains of the existing capital goods and with the (possibly changed) exogenous variables, they form the initial conditions for the next period, the second act. A new equilibrium emerges and this goes on in subsequent periods. Apparently, capital endogenously transfers wealth from period to period.

Like his father, Walras made a distinction between consumption goods and capital goods, i.e. production factors. He thereby distinguished three types of capital: (1) land, (2) human capital and (3) capital proper (fixed capital: houses, machines, etc., and circulating capital: stocks of products and money).

During a period, the entrepreneurs hire capital of all three types, that is to say, they buy services of this capital and use it during the period in question. One of the entrepreneurs’ tasks is to take care that services bought are transformed into consumption and capital goods proper. The price they pay for these capital services to the owners is used by the latter to buy consumption goods, from the entrepreneurs, or to save.

Accordingly, there are four types of agents: (1) landowners, (2) labourers, (3) capitalists and (4) entrepreneurs. One or more of these types may be united in one and the same person.

Walras clearly pointed out this in the competitive markets of his model simultaneously:

1. Demanders will bid higher prices in case of excess demand and suppliers will ask lower prices in case of excess supply; this will eventually, in equilibrium, reduce excess demand and supply in all markets of goods and services to zero.
2. If in a certain branch the cost price is higher than the selling price, entrepreneurs in this branch will leave it or will decrease their production, and if the cost price is lower than the selling price, the opposite will take place; this will make the cost price of each product equal to its selling price and bring equilibrium profit rates to zero.
3. Similarly, the use of capital services and the formation of new capital will be shifted by entrepreneurs and capital owners from one application to another, until eventually the ratios of the net revenue (after having taken account of wear and

tear) per unit of some capital good and the selling (= cost) price of it are the same for all capital goods; this will make the total amount of gross savings equal to the total value of newly produced capital, and all capital goods equally profitable.

4. This same ratio, finally, will be the equilibrium rate of interest that equalises total demand and supply in the money market.

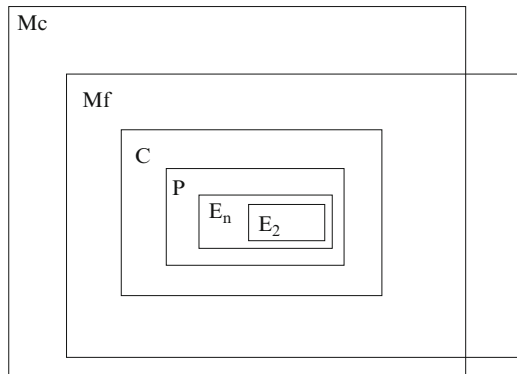
These four points together describe a situation of economic equilibrium in the period considered in its most comprehensive form. They generate what a spectator sees in this “theatre of economic life”. Walras presented them as separate “scenes” in his play, but in reality, they take place simultaneously, of course. They result from the mathematical model (to be dealt with in the next sections), which, as such, is invisible on the stage. It is, therefore, invisible on the stage that in the equilibrium situation, each individual’s utility is at its maximum given the equilibrium prices. Furthermore, these prices are for each individual proportional to his marginal utilities. Walras reserved a special name for this marginal utility: *rareté*.

## Approaching the Reality of Free Competition

Walras had a whole sequence of models from simple to highly complicated. Above, we were talking about the last one of this sequence, the most complicated and most complete model. We chose to start with presenting this one, because we wanted to start with the end since most students never come to it. With his chain of cumulative models of general economic equilibrium, Léon Walras was one of the first economists to make use, for pedagogical reasons, of the method of decreasing abstraction. In order to explain his ideas on economic equilibrium, he first devised, in Part II of the *Éléments*, a model dealing with a group of people possessing a quantity of some good (A) who want to exchange this, whether or not partly, for some quantity of good (B) owned by the people of a second group who, on their turn, want to exchange this against good (A). These exchanges take place, of course, under a regime of free competition. Adding up the individual demand curves, based on utility maximisation, Walras obtained aggregate demand functions for (A) and (B) and from these, he came to aggregate supply functions for (B) and (A) respectively. In equilibrium, there is equality of aggregate demand and supply. This was extended, in Part III of the *Éléments*, into a model of exchange of an arbitrary number of goods, the one we started with in the introduction.

Walras’s next step (Part IV) was building his “model of production”, in which only consumer goods are produced, by using services of land, human capital and capital goods proper (i.e. no circulating capital). Production is, as we know, characterised by fixed coefficients of production. All capital services are used up in either production of consumer goods, or in personal consumption (leisure, riding their own horses, living in their own houses, etc.). The model of production was enlarged in Part V to the “model of fixed-capital formation” in which production of capital goods proper was included. Finally, in Part VI, the model of capital formation was expanded into two models, one with circulating capital and fiat money

**Fig. 18.1** Walras's equilibrium models



(e.g. paper money) and one with circulating capital and commodity-based money (gold, e.g.). All these models, except the last one were intended as pedagogical devices, to explain this last one, to be used for policy recommendations. For all Walras's models, modern proofs of the existence of a solution exist now (see § 7). Below, the models have been placed in a scheme that represents their hierarchy.  $E_2$  indicates the model of exchange of two goods only,  $E_n$  the model of exchange of  $n$  goods only,  $P$  the latter extended with production of consumer goods,  $C$  denotes model  $P$  extended with formation of fixed capital,  $Mf$  signifies model  $C$  extended with circulating capital and fiduciary money and, finally,  $Mc$  stands for model  $C$  extended with circulating capital and commodity-based money (Fig. 18.1).<sup>4</sup>

We end this section with some considerations concerning the relevance of Walras's successive models for present-day economics. With his method of decreasing abstraction, Walras attempted to approach the reality of a situation of free competition. Note that equilibrium in a period is followed by equilibrium in the next period, equilibrium in the then next period, etc. As stated above, the subsequent equilibria may differ in initial conditions. Preferences may change and technology may improve exogenously, whereas stocks of capital goods will change endogenously. Walras assumed thereby that the equilibrium prices of the present period are expected to persist.<sup>5</sup> This implies that we have agents with highly myopic expectations: in a given period, future capital income is assumed to be constant over all periods to come. Changes in preferences, technology and available capital and its future income are not foreseen. Hence, the sequence-of-periods equilibria (or temporary equilibria) are not likely to be coordinated over time. So, we note that a general *inter-period* equilibrium is not implied by Walras' analysis. Agents are not assumed to have rational expectations in Muth's sense.<sup>6</sup>

<sup>4</sup>The hierarchy is not complete (see Van Daal 1994; Van Daal and Jolink 1993b, Chaps. 14–16).

<sup>5</sup>See Van Witteloostuijn and Maks (1988 and 1990).

<sup>6</sup>In the case of Walras, a non-econometric, or perhaps pre-econometric case, we mean with the expression "rationality in Muth's sense" that economic agents are (supposed to be) at least as clever as the economist who is modelising their behaviour concerning the formulation of expectations for the (near) future. See Muth (1960, 1961). Walras's agents seem to be much more stupid.



It is more and more acknowledged nowadays that Walras' analysis of free competition only offers a scope for a sequence of uncoordinated temporary equilibria.<sup>7</sup> This might play a role in the debates on free competition and economic progress.<sup>8</sup> One of the most serious failures of "free competition" is perhaps its apparent inability to coordinate events over time, which may substantially reduce free markets' capacity to generate steady decreases in scarcity or, in more familiar terms, to increase society's welfare. If the free markets would follow capricious animal spirits, serious damage may occur in terms of volatility, recessions and crises, and substantial losses might result.<sup>9</sup> Most important, fundamental economic debates are related to this question now and will be in the near future.

But this is not all. Walras takes a further step in approaching the reality of free competition. Probably, this is best demonstrated by the following quotations (*Éléments*, §322):

Finally in order to come still more closely to reality, we must drop the hypothesis of an annual market period and adopt in its place the hypothesis of a continuous market. (...)

Such is the continuous market, which is perpetually tending towards equilibrium without ever actually attaining it, because the market has no other way of approaching equilibrium except by groping, and, before the goal is reached, it has to renew its efforts and start over again, all the basic data of the problem, e.g. the initial quantities possessed, the utilities of goods and services, the technical coefficients, the excess of income over consumption, the working capital requirements, etc., having changed in the meantime. Viewed in this way the market is like a lake agitated by the wind, where the water is incessantly seeking its level without ever reaching it. But whereas there are days when the surface of the lake is almost smooth, there never is a day when the effective demand for products and services equals their effective supply and when the selling price of products equals the cost of productive services used in making them. The diversion of productive services from enterprises that are losing money to profitable enterprises takes place in several ways, the most important through credit operations, but at best these ways are slow. (...)

For, just as a lake is, at times, stirred to its very depths by a storm, so also the market is sometimes thrown into violent confusion by crises, which are sudden and general disturbances of equilibrium. The more we know of the ideal conditions of equilibrium, the better we shall be able to control or prevent these crises.

It might be worthwhile to read and reread these quotations, realising that these lines have not been written by Keynes or a Keynesian economist, or by a neo-Austrian or an evolutionary economist, but by Walras, much more than one century ago.

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<sup>7</sup> See Van Witteloostuijn and Maks (1988 and 1990), McKenzie (1987): 503 and Van Daal and Jolink (1993b): 74.

<sup>8</sup> Walras defined this as follows (*Éléments*, § 327): "Progress (...) consists in a diminution of the *raretés* of the final products along with an increase in population". See also Lionel Robbins's seminal *An Essay on the nature & Significance of Economic Science* (Robbins 1932), where scarcity "means limitation in relation to demand" (p. 46). This book perhaps caused the breakthrough of the neo-classical (Walrasian) definition of economics: "Economics is the science which studies human behaviour as a relationship between ends and scarce means which have alternative uses" (p. 15.).

<sup>9</sup> See for similar wordings Keynes's *General Theory* (Keynes 1936, Chap. 13).

## Systems of Equations and Existence of a Solution

Let us now concentrate on the systems of equations and their foundations. The solution of the equations of the most extended model yields the most general of the situations of economic equilibrium considered by Walras, as we have seen in section 4: prices, wages and the rate of interest at which markets clear (demand equals supply); further, they yield market-clearing quantities of all goods and services in the period in question. In underpinning these equations, Walras paid most of his attention to consumers' behaviour. In 1900, in a letter to Knut Wicksel, he wrote "[My theory] is the pursuit of *Grenznutzen* [marginal utility] in the last details of economic equilibrium". At the same occasion, he declared to leave further development of the production side (marginal productivity, for instance) to his successors.

Since the individual consumers own the capital goods, entrepreneurs can only provide themselves with capital services by renting land from landowners, by employing workers or by hiring capital. Of course, as we already said, combinations of two or more of the roles of landowner, worker, capitalist or entrepreneur in one person may exist.

Selling capital services procures the individual an income that permits him to buy consumption goods and capital services, and to repair or replace pieces of capital to keep his stock at the level of the period's beginning. The rest of this income is per definition net savings (negative, zero or positive). Walras assumed that positive net savings are used to buy newly produced capital proper in order to assure the savers in question a future income increase. Hence, *three kinds of variables* appear in the (additively separable) individual utility functions: firstly, quantities of the various consumption goods; secondly, quantities of the services of capital goods to be consumed by the individual himself and thirdly, the amount of expected additional future income.<sup>10</sup> From these utility functions, Walras derived individual demand and supply equations, by assuming that consumers maximise utility, given their income and the prices. One may consider these demand and supply functions as schedules from which a consumer can infer, at every price constellation, the quantities of the various goods and services that will yield him maximal utility at these prices. With these schedules in mind, as it were, he enters the markets. Aggregated, i.e. added up per good or service over all the individuals, these schedules enter into the model. We stress once more that Walras was aware that preferences (as described in the utility functions) might change from period to period.

The production side of the models is less developed. For simplicity's sake, Walras supposed *constant coefficients of production* in his formal models. So he assumed that for production of a unit of some product, fixed quantities of productive services

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<sup>10</sup>By introducing present utility of the expectation of future additional income, Walras was able to bring himself "as close as possible to the dynamic point of view" in his formal models (*Éléments*, editions 4 and 5, §272). Here is meant "inter-period dynamics", in contradistinction to the "intra-period dynamics" of tâtonnement. It is again to be emphasised that the expected future income is based on a very simple myopic expectations scheme: agents assume that the equilibrium prices of the period considered will also hold in the future; see Maks and Van Witteloostijn (1987, 1988, 2001).

are needed, irrespective of the level of production. It may be that at Walras's time, this was less arguable as it appears to be now. Anyway, the result is a set of relatively simple production functions. But, of course, he was aware that the coefficients of production, constant within a period, may change over the periods. Moreover, in his analysis of the conditions and consequences of economic progress, he emphasised the variability of the production coefficients. In Part VII of the *Éléments*, editions 4 and 5, lesson 36, § 326 (Walras 1988: 589), he set out how the production function in the regular flexible form of the textbooks can be introduced.<sup>11</sup> He concluded there the following:

1. Free competition brings the cost of production down to a minimum.
2. In a state of equilibrium, when cost of production and selling price are equal, the prices of the services are proportional to their marginal productivities, i.e. to the partial derivatives of the production function.

To the production functions (with the fixed production coefficients) and the (aggregated) demand and supply functions are added equations expressing the final result of free competition: market clearing for all goods and services, money included, equality of selling price and the cost price of each product, equality of the interest rate to the ratio of net revenue and the cost price of every capital good. To give an idea of the size of Walras's system in the version without money, let us suppose that there are ten types of consumption goods, three types of land, three types of human capital, three types of capital proper and four types of raw material. Then Walras's most comprehensive model consists of 88 equations, with 88 variables. Using the individual demand and supply equations, individual quantities demanded and supplied can be found. The latter quantities are amounts of goods and services that maximise the individual consumers' utility, given the equilibrium prices.

Now we turn shortly to the existence problem. Since the coherence of his theory depends on it, the existence of a solution of his systems of equations was most important for Léon Walras. In his days,<sup>12</sup> the method of counting equations and unknowns was widely used in pure mathematics and in economics, although one was aware that systems might be inconsistent and equations redundant. The equality of the number of the variables of the model to the number of independent equations was, therefore, important enough to Walras for meticulously counting equations and variables. Nevertheless, he dealt quite subtly with this question. As Jaffé rightfully observes in a translator's note (Walras 1954: 502), Walras does not belong to those economists who only count equations.<sup>13</sup> In the context of the exchange model (*Éléments*, §§ 65–68), Walras analyses the possibilities of having a unique solution, a multiplicity of solutions or no solution at all. This follows from an interesting

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<sup>11</sup> While staying within the realm of constant returns to scale.

<sup>12</sup> And later; see Bowley (1924).

<sup>13</sup> Or (Schumpeter 1954: 1006): "Of all the unjust or even meaningless objections that have been levelled at Walras, perhaps the most unjust is that he believed that the existence question is answered as soon as we have counted 'equations' and 'unknowns' and found that they are equal in number".

figure in the *Éléments* (Plate I; Walras 1954: 110–111; 1988: 86) in which supply and demand intersect in three points. The point in the middle is an unstable equilibrium. The other two are locally stable.<sup>14</sup> In discussing the situation depicted in this figure, Walras firstly points out that the shape reveals the possibility of several, in this case three, equilibrium points. Then he goes on to explain that one of the intersection points is instable because (*Éléments*, § 67):

[I]n this case, to the right of the point of equilibrium, the demand for the commodity in question is greater than its offer, which must lead to a rise in price, that is, to a movement farther and farther away from the point of equilibrium. And, in this same case, to the left of the point of equilibrium, the offer of the commodity in question is greater than the demand for it, which must lead to a fall in price, that is, to a movement once again away from the point of equilibrium.

He goes on explaining the nature of the other two equilibrium points. Both are locally stable. One is associated with a high quantity and a low price, the other with a small quantity and a high price. From these observations, one may safely conclude that Walras knows that counting (independent) variables and equations is neither sufficient nor necessary for the existence of a unique stable equilibrium. He even distinguishes stable and unstable equilibria, as we saw. He was also the first economist to associate an instable equilibrium with a backward bending supply curve and a more steeply falling demand curve (Jaffé, translator's note, 1954: 504).

Later, existence proofs meeting the most rigorous standards of modern advanced mathematics have been found.<sup>15</sup> This, however, is of such a technical nature that it is impossible to deal with it within the scope of this article. Having dealt with the existence of equilibrium in a period, the question rises how such equilibrium might be brought about, starting from the period's initial situation. Let us, therefore, pass to Walras's tâtonnement.

## Tâtonnement

There is a great discrepancy between Walras's tâtonnement and what is called Walrasian tâtonnement in the literature. He devised it as a means "to establish that the theoretical solution and the solution of the market are identical" (*Éléments*, §124), but it has become one of the most misunderstood notions of his heritage. In devising the notion of tâtonnement, his intention was to show that the outcome of the equations of the model is, indeed, the same as the outcome of the market process in the period under consideration. The essence of the process of tâtonnement is that buyers will bid up prices in case of excess demand, sellers underbid in case of excess supply and entrepreneurs withdraw from the industries where they incur losses and enter those where benefits may be expected. In Donald Walker's (1996) book,

<sup>14</sup> See also Van Daal and Jolink (1993b), Fig. 4.5 (p. 26).

<sup>15</sup> See Van Daal (1998), where proofs are presented for all Walras's models.

it has been made clear that it is not some authority above the groups to determine prices (and quantities); the groups themselves do this. This means that there is no need for an auctioneer in Walras's models. Thus, the word "auctioneer" is absent in all Walras's writings. It is an invention by later authors, attempting to grasp and explain the working of Walras's models, in particular those from the fourth edition of the *Éléments* onwards. Tâtonnement, furthermore, is something that entirely takes place within a certain period and is connected with the existence and the nature of equilibrium in that period only. It has, therefore, nothing to do with the transition from equilibrium in a period to that in the next one (see below).

The idea of Walras's tâtonnement is as follows. For simplicity's sake, we restrict ourselves to the case of simple exchange, unaffected in all editions of the *Éléments*. As a matter of fact, this case is the only one that is generally known in some form or another to present-day economists. There are  $m$  goods to be exchanged, indicated by (A), (B), (C), (D)...; (A) is the numéraire. For the non-numéraire goods, there are  $m-1$  excess demand equations; further, there is the budget equation. Hence, if there is zero demand for  $m-1$  goods, then excess demand for the  $m^{\text{th}}$  good is also zero. A vector  $p_1$  of prices of the  $m-1$  non-numéraire goods is cried at random (the price of (A) is equal to 1). These prices will in general not produce equality of demand and supply in all markets. Hence they are not equilibrium prices and trade will not take place. Starting from this vector  $p_1$ , Walras presented a procedure to find a second vector  $p_2$  more close to the equilibrium prices. This was done in several steps. The first step was to replace the first price of  $p_1$ , the price of (B), by one that, together with the other prices of  $p_1$ , brings about market clearance for (B). By a mathematical argument, he made plausible that such a new price for (B) exists.<sup>16</sup> The second step was replacing the price of (C) by one that brings about equality of demand and supply in the market for (C), together with the changed price of (B) and the rest of the prices of  $p_1$ . This change will most probably disturb the equilibrium in the market for (B). Going on, a new vector  $p_2$  of prices results. It will in general not bring about general equilibrium, because continuing the construction of  $p_2$  will offset an equality just fulfilled. But Walras argued (or, rather, supposed) that these latter, so-called secondary effects might be expected to have a smaller impact on a price than the primary effect, i.e. the effect from the change of this price itself. Moreover, secondary effects do not all have the same signs and may, therefore, cancel more or less. So Walras concluded that  $p_2$  lies nearer to the equilibrium price vector than  $p_1$  in the sense that all excess demands for  $p_2$  are closer to zero than those for  $p_1$ .

Similarly, starting from  $p_2$ , a vector  $p_3$  of prices can be obtained that will bring the inequalities of demand and supply still nearer to equality, and so on. Hence, Walras concluded, there are prices that will bring to zero the excess demands of all the  $m$  goods. These prices – obeying the equations of the model – are the equilibrium prices and transactions may start. This process of tâtonnement, as Léon Walras baptised it from the first edition of the *Éléments* onwards, reflects reasonably well the phenomenon of outbidding and underbidding as it happens

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<sup>16</sup> Walras supposed that demand and supply curves are so located and shaped that they intersect.

in well-organised markets. In the Bourse of Paris, for instance, transactions were only allowed if demand equals supply for all shares and bonds. See Walker 1997. The way in which this was brought about was Walras's inspiration for the reasoning above. It cannot be denied that Walras's idea of the primary and secondary effects is highly suggestive, but he did not work it out into a rigorous proof of the convergence of tâtonnement. Later generations of economist had to complete it in this respect.<sup>17</sup>

In the first three editions of the *Éléments*, Léon Walras developed very complicated tâtonnement processes for the other models of his sequence, those with production. In these cases, the initial situation was not a vector of prices only, as  $p_1$  above, but a vector of prices of productive services together with quantities of products to be produced in first instance. In these first three editions of the *Éléments*, Walras admitted of *disequilibrium production*. The goods produced in disequilibrium were exchanged according to a tâtonnement process, as described above. The announced vector of prices and quantities is unlikely to generate a situation of general economic equilibrium, but Walras was able to derive from it a new situation closer to equilibrium. This situation was then used as a new initial situation to find a third situation still more close to equilibrium, and so on. The details are highly complicated, while the idea of primary and secondary effects is profusely applied. See Van Daal 2000. So, in first instance (i.e. in the first three editions of the *Éléments*), tâtonnement was really intended to reflect dynamics of daily economic life during a period. Consumers work, get money, buy goods and consume them; producers hire workers, buy raw materials and intermediate products, produce products and sell them; capitalists save and the money saved is invested in capital goods. Between all these things, there exists some order, and it is this what Walras tried to model by means of the tâtonnement in the first three editions of his *Éléments*.

From the fourth edition of the *Éléments* onwards, Walras removed disequilibrium production from his models because it might lead to inconsistencies.<sup>18</sup> Instead the agents respond now with written "pledges".<sup>19</sup> These pledges present actions that

<sup>17</sup> Indeed, later authors have elaborated on it, proving rigorously the convergence of the sequence  $p_1, p_2, p_3, \dots$  of prices to equilibrium prices. Allais (1943, vol. 2: 489 ff.) was the first to provide in this way a proof of the existence of equilibrium in the case of exchange only: he had to impose the condition of so-called gross substitutability. See also Morishima (1977), Chap. 2.

Nevertheless there is somewhat more to say. Walras assumes that his *rareté* functions only depend on the quantity of the own commodity and are always (dis)continuously decreasing in that quantity. This can be seen in all graphs depicting *rareté* curves, (*Éléments*, §§ 74–84). Hence, the *rareté* functions do not shift if the quantities of the other commodities change. Starting from this concept and assuming that the marginal utility elasticities of all commodities vary (on the average) in their normal range between 0 and  $-1$ , it can be proved that gross substitutability holds and that the prices  $p_1, p_2, p_3, \dots$  indeed converge to equilibrium prices (see Maks 2006).

<sup>18</sup> For that same reason, Walras had discarded from the outset the possibility of disequilibrium transactions in the case of exchange only.

<sup>19</sup> Walras's French word was "bon". Jaffé translated it as "ticket". We prefer the translation "pledge", proposed in Walker (1987a).

the agents would undertake in answer to the “crying” of prices and quantities and that should be binding if they generate equilibrium. Generally, this is not the case in first instance, and then these pledges give rise to new cries. The play of crying and pledging will continue until equilibrium prices are reached. Then production and exchange are permitted to take place according to the “equilibrium pledges”.<sup>20</sup> As a consequence of this unhappy modification, however, Walras had to suppose in his models of the last two editions that the whole economic process of a period, in all its complexity, had to take place simultaneously and instantaneously. This means an enormous decrease of the degree of reality of the models.<sup>21</sup>

The way Walras amended tâtonnement in the fourth edition of the *Éléments* has reduced it, in fact, to a mathematical device for an alternative proof of the existence of equilibrium, no more, no less. Walras’s original tâtonnement, of the editions 2 and 3, has become so unknown that it has been reinvented under the name “*non-tâtonnement*”, of all names.

We observed already that tâtonnement has nothing to do with inter-period dynamics. This latter kind of dynamics deals with the transition from a period to the next one, in particular what happens in a certain period may depend on what happened in preceding periods; see above, § 5. It is, however, in the context of *inter*-period dynamics that tâtonnement has sometimes been (mis)understood in the literature. Walras himself did not explicitly elaborate inter-period dynamics, though it was certainly in the back of his mind. He was rather dealing with what may be called *intra*-period dynamics, viz. his tâtonnement. Where the interpretation in the context of *inter*-period dynamics seems to be incorrect, it is not surprising that tâtonnement started an own life and evolved into a direction that, however interesting, does not have much to do with Walras’s work itself. As it stands now, he would hardly have recognised it.<sup>22</sup> Alternatively, some authors went as far as associating tâtonnement with the problem of stability of equilibrium, which Walras had only taken up for the case of exchange of two goods; in fact, this is simply studying stability of tâtonnement itself, no more, no less.

Now we turn to Walras’s applied economics. We start with monopoly.

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<sup>20</sup>For a comprehensive and authoritative discussion of all tâtonnements and of Walras’s way of trying to embed this in an institutional framework, we refer to Walker (1996). In particular, we refer once more to Walker’s explanation of how the market agents can do without an auctioneer.

<sup>21</sup>At the same time, it means a complete change of what happens during a period. The models with production (i.e. all models after those of pure exchange) of the third edition describe quite other “events” during a period than those of the fourth.

Walker, too, considers the new tâtonnement as unfortunate. He appears to be a partisan of its predecessor. Personally, we think that both are problematic (see Van Daal 2000).

<sup>22</sup>The mechanism that transforms a price vector into the subsequent one differs in most modern textbooks from that invented by Walras himself. Walras’s procedure works consecutively, price by price, and the process goes through a number of intermediate situations. In the textbooks, all prices change mostly instantaneously and simultaneously in one single non-stop flight from the initial value to the equilibrium prices (see Van Daal 2000).

## Free Competition and Monopoly; Private and Public Goods

Walras drew some general principles from his equilibrium models that might be used in economic policy. A highly important conclusion in this respect was that free competition should be the rule, *provided that its conditions be fulfilled*. In a situation of equilibrium under free competition, each consumer obtains the highest possible utility, given the equilibrium prices. His income follows from them, because then there are only incomes from capital, i.e. from land, human capital and capital proper; there are no profits, or losses. Walras saw all this as highly attractive, and *he was of the opinion that the eventual state of the economy should resemble as most as possible a situation of free competition, at least in its outcome*.

Which are these conditions? Walras mentioned two necessary conditions: (1) the goods must be susceptible of private ownership, and (2) they must be produced by a large number of enterprises. The first condition means that public goods cannot belong to the realm of free competition. Hence, Walras paid a lot of attention to these goods in his social economics. In particular, he had to deal with the production of and the payment for them. The latter aspect brought him upon the subject of taxation. The second condition led Walras, in his applied economics, to investigate monopoly and negative effects of monopoly profit. Under what circumstances might monopoly be admitted and how should it, then, be regulated? There are three situations to be distinguished regarding the two conditions above:

1. Both conditions are fulfilled.
2. Condition (1) only is fulfilled.
3. None of the conditions is fulfilled.

We shall consecutively deal with these three situations.

In the first situation, free competition can do its work. This does not mean that things can be left to themselves. No *laissez faire* in this case. Instead, free competition implies active participation of the State. In his *Études d'économie politique appliquée* (further to be called *EPA*), Walras left no room for misunderstandings, when he says, for instance (Walras 1992: 426–427), the following:

Saying free competition is absolutely not saying absence of all *State intervention*, as one will see. First, this intervention is necessary for establishing and maintaining free competition there where it is possible. Landowners, labourers and capitalists are inclined to establish monopoly of services. Entrepreneurs are inclined to establish monopoly of products. If such monopolies would be against public interest, then the State has to stop it in any case that it is not based on natural right. (...)

(...) Nevertheless, let us repeat here that instituting and maintaining free competition in economics in a society is an undertaking of legislation, very complicated legislation, belonging to the State.

Thus, Walras advocated a kind of regulated free competition, a framework of rules in which the economic agents interact in relative freedom. These rules regard a wide variation of issues: minimum prices, mutual price agreements between the enterprises, advertising, product information and consumer credit.



In the second situation, there are private goods that cannot be produced by a great deal of relatively small enterprises. Walras's examples were water, gas and railway transport. All kind of price manipulations, as monopoly price fixing and price discrimination, should be subject of State intervention to ensure equality of the, single, selling price of each product to its cost price. Walras says it as follows (*EPA*, p. 268; 1992: 247–248; capitals and italics in original):

Furthermore, the functioning of economic competition presupposes essentially “the possibility of a shift of entrepreneurs to enterprises who make profit and withdrawal from enterprises at loss”. There are several reasons that may prevent that this shift will take place and that will turn an enterprise into monopoly. This may be the case from the beginning onwards as we have seen with respect to bringing of water or gas into a city, or the construction and exploitation of a railway between two cities. It may also occur after a certain time because of special features of the enterprise in question: for instance, in an industry where general costs are at the same time considerable and sensibly fixed. In both cases competition would not work. A few entrepreneurs disposing of huge amounts of capital would first kill the small ones. After that, they would contest till the extermination of all by one of them or by a coalition of two or three surviving firms until monopoly will occur anyhow. Monopoly procures maximum satisfaction of the needs only under the reservation of maximum benefit of the entrepreneur. Hence:

— *In the interest of society and excluding exceptions founded on natural right, the STATE should undertake production at cost price of SERVICES AND PRODUCTS OF PRIVATE INTEREST, NOT SUSCEPTIBLE TO INDEFINITE COMPETITION, or it should concede this production, under a monopoly on its behalf, to the lowest bidder at an auction on the selling price.*<sup>23</sup>

As an example of an exception founded on natural right, Walras mentioned the case of an inventor of a new product or of a new production technique, beneficial to society. Such an inventor should be granted to benefit from his invention by permitting him to keep his secret for himself during a certain period.

In addition to the *economic monopolies* of the foregoing situation, there are also so-called *State monopolies*, in case of situation three. No individual appreciation of the goods and services in question through the notion of individual utility exists. Their wants are collective, public. One could think of defence, police, administration

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<sup>23</sup> Presumably, Walras meant here that enterprises interested in producing and distributing, say, gas under monopoly in some city, meet in an auction to try to get the concession. This auction might be organised as follows. The interested parties are invited by the auctioneer to propose a price at which they will produce and supply the product. The price proposed by the first bidder will perhaps exceed the cost price of one or more of the parties. Then the auctioneer tries to solicit a lower selling price. Let us suppose that somebody makes such a bid, possibly still above one or more cost prices. A third selling price might then be proposed, and so forth. Under certain conditions, this process might converge to a bid equal to the cost price of the most efficiently producing party. Here, we cannot speak of a Dutch auction, where the auctioneer starts with a high, unacceptable price and then proposes prices gradually lower and lower and where the first participant who calls “mine” at a certain price is bound by it. In an “English auction”, the auctioneer tries to solicit higher and higher bids from the participants, till nobody wants to make another bid. The highest bidder is then bound by his bid. Both systems are aimed at the achievement of a final price as high as possible. See, for instance, Vickrey (1961). The procedure indicated above in the case of Walras might perhaps be called an “inverse English auction”.

of law, infrastructure and so on. The production of these goods can hardly be expected from the particular initiative. Walras suggested that the State should engage in their production (*ibid.*, capitals and italics in original):

Individuals appreciate services and products of private interest and the State services and products of public interest. Individuals feel and measure wants for bread, meat, clothing, furniture; the State for troops, courts, schools, and roads. Since there is in general an indefinite number of consumers of services and products of private interest, there will, as a result, be an indefinite number of entrepreneurs, whereas there will be no entrepreneur for services or products of public interest, for there is in general only one single consumer. Who will think of something as constructing a stronghold or organising a university for selling it or renting it out to the State? Hence:

— *In the interest of society, the STATE should undertake production of SERVICES OR GOODS OF PUBLIC INTEREST THAT ARE NOT PRODUCED BY PARTICULAR INITIATIVE.*

## Ownership and Taxation

In the foregoing paragraph, we dealt with Walras's preoccupation with the right conditions for an abundant production of social wealth. However, how should this wealth be distributed among the members of the society? An important part of Walras's *Études d'économie sociale (EES)* deals with this problem of (just) distribution, which can be separated into the problems of ownership and taxation (*Éléments*, § 8; 1988: 31):

[T]he theory of property and the theory of taxation are simply two aspects of one and the same theory of distribution of wealth in human society, the first representing this society as composed of separate individuals and the second representing it as a collectivity in the form of the State.

Walras's point of depart in dealing with the notion of property was that "the owner of a thing is the owner of the services of it (...) as well as of the [money] price of it" (*EES*, pp. 206–207; 1990: 178). Hence, property rights of products originate through exchange from those of the capital goods, land, personal capital and capital proper. The latter kind consists of products as well and should, therefore, be owned by those who have manufactured them. So the problem was reduced to ownership of land and personal faculties. Personal faculties clearly belong to the concerning individuals themselves. The times of slavery are past. Remains land. According to Walras, this belongs to all of us, not only to this generation but to all generations. Since all people have the same rights to pursue their destiny, they should all benefit equally from resources offered by nature to accomplish these destinies. Land, Walras argues, must therefore belong to the community, i.e. to the State. The State as owner of the land will be the owner of its services, and of the products obtained by these services. This provides it with an own income. In that (ideal) situation, taxes can be abolished. Rent received will enable the State to pay its expenses, and to pay back the former owners because rents will increase considerably, land becoming

increasingly scarce in future. This increase, incidentally, belongs certainly to the community as a whole and not to the individuals who happen to be the owners of the land in question. For Walras, this was another reason for putting all the land in the State's hands.

Taxation, either on income, or on capital other than land, either direct or indirect, is unjust, says Walras, because it is a claim by the State on a thing it does not possess. Taxes, or subsidies as negative taxes, will always lead to some aberration from the pursuit of giving each economic agent what is rightly his. Wealth is the reward for labour and savings; poverty is the consequence of and penalty for idleness and prodigality (*EES*, p. 438; 1990: 404):

Individual moral will have its natural sanction and the State may leave it to the individuals to ask freely to religion or philosophy the aid they need to endure hardships of nature or to overcome own weakness. Taxation will bar the way to that ideal.

Accordingly, the State might consider both a land tax and the expropriation of land. In the first case, the State would be, in fact, a kind of co-owner of the land. In the other case, a rightful repurchase of it must take place.

This repurchase takes a long period. The actual situation in Walras's time was one in which the land was privately owned, even though the French revolution could have changed this, as he contended. The question was how the State can obtain privately owned land. It should be prevented that a factual injustice be remedied by another injustice. The actual situation is not the present landowners' fault. Gossen, who claimed on similar grounds nationalisation of land, already dealt with the question.<sup>24</sup> He, too, pointed to the continually rising prices of land (services). Walras read Gossen's book (in fact, he rediscovered it, together with Jevons) in the seventies of the nineteenth century. In 1893 (Walras 1965, Letter 1172), he wrote:

The point of tangency of moral economics with pure economics can be found in the law of the surplus value of the rent of land in a progressing society.

## Blueprint of the Ideal

We saw that Léon Walras extensively dealt with monopoly and other market organisations, public goods, taxation and ownership, in particular State ownership of the land. It was always his intention to insert these elements in a comprehensive system, in which public goods would be produced by the State and this same State would be the demander of them. This may be inferred from the following citation (*EES*, p. 433; 1990: 400, emphasis added):

The idea of want curves or utility curves of the products and services of public interest would be indispensable for *completing the mathematical theory of the economic equilibrium*.

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<sup>24</sup>Gossen (1854), pp. 250–273; Chap. 23 of the English translation.

This same idea can also be found in many other places throughout the *EPA* and the *EES*. See, for instance, the passage in the last citation of § 8 above: “Individuals feel and measure wants for bread, meat, clothing, furniture; the State for troops, courts, schools, and roads”.

As already indicated above, Walras paid so much attention to pure theory that he ran out of time and the synthesis was never achieved. Some time ago, an attempt has been made to fill this lack. A broad design for the economic framework of the ideal envisaged by Walras could be synthesised in what was called “*general general economic equilibrium models*”.<sup>25</sup> In these models, the above elements have been inserted:

- All firms produce with fixed coefficients of production. This applies to production of both private goods (under free competition or (regulated) monopoly) and public goods.
- All goods are supplied at cost price, both under free competition and under monopoly.
- The State enters on the scene as an individual that plays a role that mathematically does not differ from that of an individual. The abolition of taxation combined with State ownership of land and the fiction of a social welfare function with quantities of public goods as variables has the effect that the State has a real budget constraint with rent as income and that it has a utility function just as all individual consumers.

Hence, the general economic equilibrium models can be fashioned such that they have the same mathematical structure as the models discussed in the *Éléments*. This is not amazing because, firstly, the assumption of constant returns to the scale of production, expressed in the assumption of fixed coefficients of production, is maintained and hence marginal costs and average costs will always coincide. Secondly, the demand side does not change formally. Consequently, regarding optimality, these extended models do not differ from the models exposed in the *Éléments*.

*Walras believed that under these circumstances, people have more chance than in any other economic order to come to a situation of wealth by using their own abilities and their own gifts.* This, we think, is Léon Walras’s solution to the Social question.<sup>26</sup>

## Digression on Money

In the ideal situation envisaged by Léon Walras, where misery belongs to the past, prices should not fluctuate unexpectedly, haphazardly. Therefore, he proposed a system of *global* price control. Any particular price should neither be controlled nor

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<sup>25</sup> Van Daal and Jolink (1993a, b), pp. 120–126; see also Van Daal (1999).

<sup>26</sup> Albert Jolink (1991, 1996) perhaps was the first to present a complete view of Walras’s oeuvre from an evolutionist standpoint with the Social Question as the continuous thread running through it.

prescribed, but measures should be taken such that the price system as a whole will “behave well”. Therefore, Walras proposed his well-known project for reform of the monetary system. The essence of his proposal was that (1) gold should be the money commodity, with the same value both as money and as merchandise, (2) there should be silver money<sup>27</sup> to be brought into circulation or withdrawn in adequate quantities by the State in order to stabilise the price level. In addressing himself to the meeting of the Latin Union (Belgium, France, Greece, Italy and Switzerland; a first European monetary union), he said it as follows (*EPA*, p. 17; 1992: 16, italics added):

The silver token should be minted by the State; it will only circulate within the country of its emission and will only be accepted for payments up to a certain amount. The quantity of token that may be issued by each of the States forming the Latin Union will be determined by international conventions. This should be done (...), as regards to the regulating token, *for assuring a regular variation of the value of money*. Every State of the Union will benefit of profits and will bear losses coupled with issue or retreat of its token.

In many papers, Walras went at length to explain this “open-market policy *avant la lettre*”. He thereby introduced the ephemeral notion of the “economic tides”, borrowed from Jevons. The monetary authorities should be well aware of the time of ebb and flood in the economic tides. Therefore, Léon Walras pleaded for better statistics. He gave thereby many practical hints and stressed some fundamental ideas. Highly important, he said, is the fact that the issue of banknotes can be part of the cause of instabilities. In his “*Théorie mathématique du billet de banque*” (*EPA*, pp. 339–375, dating from 1879; 1992: 311–342), he went at length in analysing the nature of banknotes and in exposing their disadvantages.

The economic tide as such is according to Walras a natural phenomenon that should not be influenced as such. It is the variation of the tide that must be managed, as is exemplified by Fig. 18.2 below (1992: 144). Without the introduction of the regulating token, the price level would have been represented by curve ABCDE. Introduction of silver token at the right moments would result in the curve ABCcD’dE’.

This process evolves in time and can easily be associated with an underlying sequence of Walras’s temporary (or periods’) equilibria uncoordinated over time. This lack of coordination is caused by the lack of foresight of Walras’s economic agents. See also § 5 above.

Another issue of importance in this respect is formed by Walras’s ideas on mono-metallism and bi-metallism. As often, here also he takes a middle position, which made him unpopular in all champs. The following citation makes this clear (Walras 1886, 1992: 138):

The final result of this whole study is that the greatest possible stability of prices cannot be obtained by trying to find it [exclusively] in one or another of these four systems: gold-monometallism, silver-monometallism, bimetallism, regulating token, but by making an alternating use of all four of them. One should imagine the four systems as placed in the following order [...]:

Silver-monometallism — Bimetallism — Regulating token — Gold-monometallism.

<sup>27</sup>Or, rather, *silver token*, because its real value must be somewhat less than its nominal value.

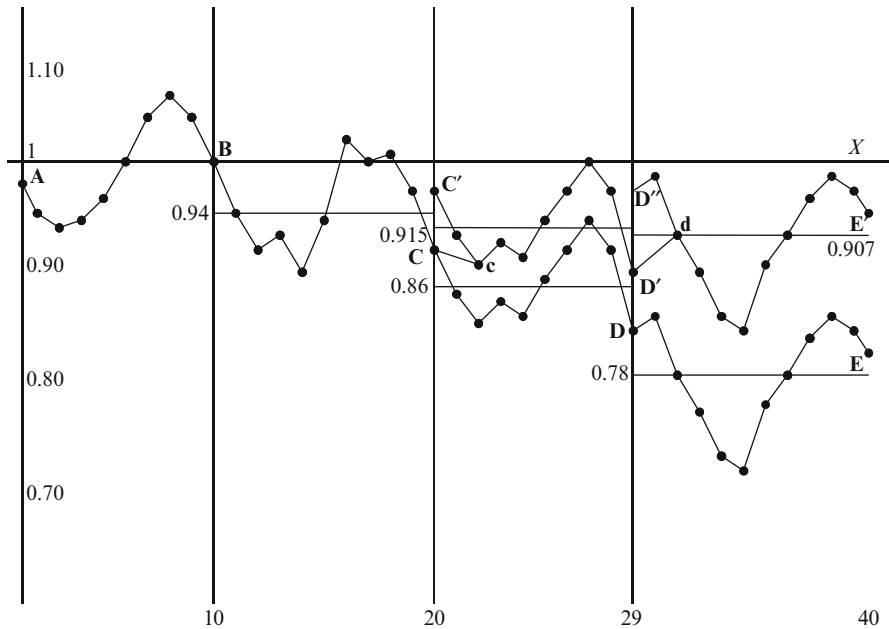


Fig. 18.2 Introduction of regulating token at time 20 and at time 29

## Walras’s Influence

### *The Period Before 1954*

In reviewing Walras’s reception in the literature, it makes sense to distinguish the periods before and after 1954. The most important reason for this separation is the publication in that year of Jaffé’s translation of the *Éléments*. In the same year, both Schumpeter’s *History of Economic Analysis* and Arrow and Debreu’s seminal *Econometrica* article “Existence of equilibrium for a competitive economy” saw the light.

Before 1954, we can hardly speak of a substantial direct “interschool” influence of Walras. During Walras’s career, Alfred Marshall (1842–1924) was undoubtedly the most important economist. His *Principles of Economics* was published from 1890 until 1920 in eight editions. In the first edition, in the last paragraph of a footnote in Appendix H, § 2, dealing with unstable equilibria, Marshall acknowledges Walras and himself as independent inventors of the theory of unstable equilibrium. In all later editions, this is omitted.

One would expect references to Walras’s *Éléments* in book V of the *Principles*: “General Relations of Demand, Supply, and Value”. Marshall is dealing here with topics clearly related to Walras’s *Éléments*. But no word is spent on the *Éléments*. Marshall only refers 2 times to Walras’s “*Économie Politique Pure*” if he addresses

the question of how to define production factors as labour (note 1, p. 138, 8th ed.) and capital (note 1, p. 788, 8th ed.). Finally, he mentions Walras without any specification as one of the authors who criticise classical value theory (p. 821).<sup>28</sup> One would at least expect a comment by Marshall, as the “master of partial analysis”, on Walras’s critical attitude regarding this type of analysis; see *Éléments*, Appendix II, from the third edition onwards.

On the other side of the Atlantic Ocean, we focus upon John Bates Clark (1847–1938). In the preface (p. x) of his *Essentials of Economic Theory*,<sup>29</sup> Clark acknowledges the influence of authors like Irving Fisher, Friedrich von Wieser and Eugen von Böhm Bawerk, but nowhere in the book a reference to Walras can be found.

Leaving these two “champions” of the Anglo-Saxon marginalists, we return to the old continent, to “the” representative of the Austrians: Eugen von Böhm Bawerk (1851–1914). His chief work is *Kapital und Kapitalzins*, published in 1884. A revised and enlarged edition was published from 1909 until 1914. The unchanged fourth edition appeared in 1921. It contains 1384 pages in three volumes. Its main topic is also covered by Walras, mainly in part V of his *Éléments*. Altogether we can find eight references to Walras. Two relate to his definition of capital, one deals with his definition of labour, two further references acknowledge Walras’s contribution to value theory, one classifies his capital theory as related to Menger’s and, in a note, Von Böhm Bawerk agrees with Walras’s opinion that the marginal utility principle also applies to altruistic actions. In the last reference (Vol. II, book 1: 458, note 1), Von Böhm Bawerk agrees with a conclusion of Walras’s capital theory. But he adds that this conclusion is deduced from an essentially flawed theory, although with valuable details. This is not further elaborated. Remarkably, in his third edition, von Böhm Bawerk refers only to the first and second editions (Walras 1874a, b, 1889) of the *Éléments*, although the fourth one was available.

From these observations, the impression emerges that the spread of Walras’s ideas into the direction of the “other schools of the marginal revolution” was not very substantial. This impression is corroborated in what perhaps still is by far the best “History of Economic Analysis”: Joseph A. Schumpeter’s, *History of Economic Analysis* (1954; see especially part IV, Chaps. 5 and 7).

Fortunately, there are exceptions. Indirect international influence originates from Italy with Enrico Barone (1859–1924) and Vilfredo Pareto (1848–1923). Firstly, it is not exaggerated to link the so called calculation debate to Walras, via Barone,<sup>30</sup> who asserts that for each economy, a central socialist plan can be calculated with the

<sup>28</sup> This meagre result is the more striking because Marshall has read the *Éléments*. The copy of the book in the Oxford University Library reveals Marshall’s hand written notes (stopping at page 169).

<sup>29</sup> E.g. the unchanged 1924 edition; the book was first published in 1907.

<sup>30</sup> And others like, e.g. O. Lange. The original version of Barone’s paper was published in 1908, in Italian. It became generally known after the publication of its English translation, “The Ministry of Production in a Collectivist State” in F.A. von Hayek (ed.), *Collectivist Economic Planning* (Barone 1935).

same outcome as a perfectly competitive equilibrium for that economy. Theoretically, the plan might be implemented by a central social agency. Barone obviously was inspired by the Walrasian systems of equations and without Walras's insights, those of Barone would have been impossible to develop.

The most important critical reaction on the calculation debate inspired by Barone's ideas came from Ludwig von Mises.<sup>31</sup> He emphasises that information about the basis on which the agents can decide and revise their demand and supply decisions only can be produced by the functioning of free markets. Without this, the necessary information about scarcities in the economy will not be revealed and, hence, will never become available to a central social agency. This implies that such an agency will never be able to calculate (in theory or in practice) the allocation corresponding to a perfectly competitive equilibrium.<sup>32</sup>

Next we should deal with Pareto, Walras's successor at the University of Lausanne. His most important contributions to economic science<sup>33</sup> are his generalisation of the extreme simple utility concept used by Walras, Jevons and Gossen, the notion of ordinality based upon Edgeworth's indifference apparatus and, of course, what nowadays is called the Paretian welfare criterion. It is obvious again that Paretian welfare economics was based upon the essence of the Walrasian equation systems and that its development would not have been very likely without Walras's perception.

Finally, it is inevitable to step outside the marginalist schools. In section seven, Chap. 7 (pp. 998–1020) of his *History of Economic Analysis*, Schumpeter reviews Walras's general equilibrium theory. This review, written in the last year (probably the last months) of Schumpeter's life, is a highly enlightening introduction to part I to VI of the last edition of the *Éléments*. For the first time, we see that the structure of the *Éléments* is exactly followed and exposed by a reviewer: exchange, production, capital and money. Unfortunately, Schumpeter does not pay attention to the parts devoted to growth, imperfect competition and taxes. Schumpeter takes much care in this exposition to point out the relations with Marshall expert John Maynard Keynes's *General Theory of Employment, Interest and Money* (1936); see page 999,<sup>34</sup>

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<sup>31</sup>L. Von Mises, "Die Wirtschaftsrechnung im Sozialistischen Gemeinwesen" translated as "Economic Calculation in the Socialistic Commonwealth" in F.A. von Hayek, ed., *Collectivist Economic Planning* (Von Mises 1935).

<sup>32</sup>Von Mises further developed his reputation as a critic of socialism. He published in 1932 his revised second edition of *Die Gemeinwirtschaft, Untersuchungen über den Sozialismus*. Since we know that Walras was advocating State ownership of the land, one might expect some reference in Von Mises's book to this idea. But in the whole book, one cannot find any reference to Walras. Even in discussing "Das Gemeineigentum an den Produktionsmitteln" (pp. 25 ff.), he does not refer to Walras.

<sup>33</sup>See *Manuel d'économie politique* (1981[1909]), translated from his *Manuale di economia politica* (1906).

<sup>34</sup>Here, Schumpeter emphasises that it is a misunderstanding to think that Walrasian micro-analysis is in need of a supplement by a Keynesian income or macro-analysis.



page 1001, note 7,<sup>35</sup> page 1013, note 38,<sup>36</sup> page 1017, note 49<sup>37</sup> and page 1023, note 65.<sup>38</sup> Dealing with monetary theory in Chap. 8, Schumpeter concludes (1954: 1082) that Walras's theory of money "simply did not exist for the overwhelming majority of economists", and he emphasises Lange's 1938 conclusion that the "Keynesian analysis of the *General Theory* (...) is but a special case of the genuinely general theory of Walras".

So, considering all the observations of Schumpeter's, one might want to know to what extent Keynes himself in his *General Theory* refers to Walras. In the whole book, there is precisely one reference to Walras, on page 177: Keynes classifies Walras as an economist in the "classical tradition" in one breath with Marshall, Cassel, Taussig and others who believe that "the rate of interest is the variable which brings [saving and investment] together".

To be fair, we should also check Keynes's reaction to Knut Wicksell (1851–1926). Apart from Walras's successor in Lausanne, Pareto, Wicksell is one of the few economists on whom Walras had a substantial influence in this period via his monetary theory. Walras wanted to maintain the separation of the real part of the economy from the part where the money interest and the money prices are determined, to be able to work with a kind of "quantity theory". Wicksell was probably the first to observe that, in this sense, money could not be neutral in the Walrasian model.<sup>39</sup> So one would expect Keynes to comment on Wicksell.<sup>40</sup> Keynes refers 2 times to Wicksell in his *General Theory*, but not very pertinently. First, he points out, without further specification, that the contemporary economists' neutral interest rate differs from Böhm Bawerk's and Wicksell's natural rate. The second reference is more relevant where he explains (pp. 242–243) that in his *Treatise on Money*, he attempted to clarify and to further develop Wicksell's natural rate theory, but that his *Treatise's* intuition appears to be untenable in the light of his *General Theory*. He defines (1936: 243) the neutral interest rate of money in a situation of an output-employment equilibrium in which the output elasticity of employment is zero. But we do not see a discussion of Wicksell's or Walras's ideas about the (non)-neutrality of money.<sup>41</sup>

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<sup>35</sup> Here, Schumpeter stresses that Walras was prepared to admit that capitalists lend money and not capital goods. He concludes that this observation is important to see the affinity between the Walrasian and Keynesian systems.

<sup>36</sup> In this note, Schumpeter warns us against making individual demand only dependent of the own price and income for pedagogical reasons. This deeply obscures Walras's approach and, in the end, it does not help the student to understand the relation between Keynesian and Walrasian economics.

<sup>37</sup> In this note, Schumpeter points out that it is not true that Walras neglected the influence of income, but Keynes neglected the influence of prices.

<sup>38</sup> Here, Schumpeter observes that the precautionary and the speculative motive for holding cash can be inserted in the Walrasian theory.

<sup>39</sup> See Wicksell's "Zur Zinstheorie" in "*Die Wirtschaftstheorie der Gegenwart*" ed. H Mayer, III, 1928 (Wicksell 1928).

<sup>40</sup> And on Pigou, who also adhered to non-neutrality of money in his *Theory of Unemployment* (Pigou 1933).

<sup>41</sup> Or to the related considerations in Pigou (1933).

When Keynes discusses the “quantity theory of money” (esp. pp. 304–4–306), he comes up with a number of equations that might or might not be compatible with Wicksell’s work.<sup>42</sup> However, Keynes does not address this question at all.

### *From 1954 Onwards*

In the year 1954, as mentioned above, three relevant publications appear. Firstly, we refer to Jaffé’s translation of the last edition of the *Éléments*. The translation made this book accessible for a much wider audience, especially in the Anglo-Saxon world. Next, we point out the appearance of the already discussed *History of Economic Analysis* by Schumpeter. Here, we see probably for the first time an adequate appraisal of Walras’s *Éléments* in a(n advanced) text book. To a certain extent, these publications can be seen as a fruitful basis for what since then happened with Walras’s legacy.

Especially after the seventies of the previous century, we see<sup>43</sup> an increasing number of publications, substantiating that this legacy is much more than the simple static general equilibrium model reproduced in most micro-economic textbooks. We should like to memorise here especially the ongoing efforts of Donald Walker that resulted in the publication of two impressive volumes *The Legacy of Léon Walras* (2001) under his editorship. These volumes bundle a considerable part of the publications that appeared since the seventies and are preceded by a valuable introduction to which we readily refer. Nevertheless, still a minority among the economists fully appreciate Walras’s legacy in its fundamental aspects as has been exposed above. This brings us to the third relevant publication in 1954.

In 1954, *Econometrica* publishes the article “Existence of equilibrium for a competitive economy” by Arrow and Debreu. They concentrate in this paper on the conditions of static equilibrium under perfect competition in the context of an economy with exchange and production. They do not focus upon capital, saving and money.<sup>44</sup> Nor do they acknowledge another essential feature: the context in which Walras develops his argument by introducing additional complexity in his subsequent models to analyse periodical or temporary equilibrium of a free market system.<sup>45</sup> In 1959, Debreu published his *Theory of Value* in which the same theory was set out once more. This booklet became most influential. Remarkably, almost every contemporary

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<sup>42</sup> Probably because the Keynesian analysis neglects relative prices.

<sup>43</sup> Together with a substantial decrease in weight of Keynesian macro-economics.

<sup>44</sup> Pascal Bridel devoted his *Money and General Equilibrium Theory* (Bridel 1997) to this important part of Walras’s oeuvre; see also Van Daal and Jolink (1993b), Chaps. 10–16.

<sup>45</sup> This is completely in line with the interpretation of Walras by Hicks (1934). Hicks claims to be the first to analyse a sequence of temporary equilibria (Hicks 1939). The previous sections have clarified that this claim is unjust.

micro-economics textbook contains a reproduction of what is presented as Walrasian general equilibrium theory that is much closer related to the Arrow and Debreu simplification than to the much richer original. This applies even to advanced textbooks as, e.g. Mass-Colell et al. 1995. This tendency in the textbooks explains to a large extent the poor state of “Walras knowledge” among what we have denoted as “cutes”.

Concluding, we can say that on the one hand, we observe a growing awareness of the significance of Walras in all his ideas, as we have attempted to sketch in this contribution, especially from the seventies onwards.<sup>46</sup> This growing awareness inspires a rich research programme varying from the role of the entrepreneur in the imperfectly competitive process (towards and away from the moving temporary equilibrium and welfare properties of such a process), to the properties of sequences of uncoordinated temporary equilibria with agents acting with less than rational expectations.<sup>47</sup> On the other hand, we observe that the majority of cutes are still trained by the narrow Debreu approach as reproduced in most textbooks.

## Conclusion

Léon Walras bequeathed to us three substantial, major books; nine smaller books and more than two hundred other publications; see Walker 1987a. Having gone through all this, we may say that his oeuvre forms a narrative on the subject of economic life that can be considered as a complete account in the sense that it deals with the functioning of practically all aspects of the economy as he saw it in his days. When one reads Walras’s works, one understands soon that persuasion certainly was one of his aims. We hope to have made evident on what points he tried to convince his readers. This could raise the question whether it would be worthwhile to subject Walras’s oeuvre, in particular its rhetoric, to an examination à la McCloskey.<sup>48</sup> A thorough analysis of Walras’s writings from the viewpoint of rhetoric would certainly give us an answer to the question why there is and always has been such a considerable gap between, on the one hand, the part of his message that people caught and, on the other hand, the totality of this message. This analysis could very well be carried out by means of the six points of Donald McCloskey’s 1994 book on persuasion. Where these points find their origin in rules for the structure of Greek discourses, Léon Walras, well versed in the classical languages, would

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<sup>46</sup> See Walker (2001). This collection (65 articles in two volumes) is the third of its kind. Mark Blaug published a volume with 25 articles in 1992 and in 1993, John Cunningham Wood a three volume set of 68 papers. Further, the volume with 19 articles by William Jaffé on Walras, edited by Donald Walker (1983), should be mentioned. Altogether, these bundles contain 148 different articles. Walker’s two collections stand out because of excellent editorial work, especially the original introductions.

<sup>47</sup> See, e.g. the mentioned volumes of Walker (2001), but also Schinkel (2002).

<sup>48</sup> See MacCloskey (1985, 1994) and also Henderson (1995).

undoubtedly have approved of such an analysis. Till now, nobody had the courage to take such an enormous job upon him.

Another interesting point regarding Walras's work in its entirety as a narrative is the question how it has been structured and whether this structure is unique, typically Walras's, or rather similar to that to be found in the other great economists' texts. In a doctoral thesis, submitted in Évry (Fréjaville 2001), first results of a study in this line have been reported. After having studied and analysed the notion of a narrative in general (and of fairy tales in particular), the author of this thesis leads us to the economic narratives. In those that may be considered as complete, one can always distinguish the following five elements: (1) individual norms, (2) collective norms, (3) behaviour, (4) mechanism and (5) the State. In Walras's oeuvre, too, these elements are clearly present. We have seen how the individual consumers' and the individual entrepreneurs' norms (maximal utility and maximal profit) lead to their behaviour in the markets. This, in its turn, gives rise to a mechanism leading to equilibrium. The outcome of this equilibrium does not always correspond with collective norms (public goods and market forms) and, therefore, we need a State to redress this. Like Adam Smith, Léon Walras must be considered as an "invisible hand economist" in the sense that individuals are considered to be ignorant of the consequences of their behaviour on the collective level; they are even uninterested in such consequences. Of course, this does not apply to the State in its roles of market regulator, consumer of the public goods and owner of the land.

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