

Léon Walras

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# LÉON WALRAS<sup>1</sup>

By J. R. HICKS

## I

LIKE John Stuart Mill and John Maynard Keynes, Léon Walras was the son of an economist. His father, Auguste Walras, was one of those excellent people (they seem to have existed since very near the dawn of history) who taught the true but unhelpful doctrine that value depends on scarcity (*rareté*);<sup>2</sup> the son followed the father's teaching, but added to it something which lifts it on to another plane of precision. He defined *rareté* as *l'intensité du dernier besoin satisfait par une quantité consommée de marchandise*;<sup>3</sup> scarcity equals marginal utility.

His position with Jevons and Menger as one of the independent discoverers of the Marginal Utility principle is generally regarded as Léon Walras' chief title to fame; and this no doubt justly enough. But anyone who comes a little closer to these writers cannot help feeling a little resentment at the habit of classifying them together, even for the joint receipt of such an honorable title. For each of them made contributions to economics which are peculiarly his own, and it is for these special contributions that they are still worth reading today.

Indeed, the modern reader of Walras' *Éléments d'Économie Politique Pure* is struck by its affinity, not with the work of Jevons or Menger, but with that of Marshall. For a quite considerable part of the way Walras and Marshall go together; and when they separate, it is a difference of interests, rather than of technique, that divides them. While Walras was seeking for the general principles which underlie the working of an exchange economy, Marshall forged an analytical instrument capable of easier application to particular problems of history or experience. Yet, since the followers of Walras cannot always afford to be pure philosophers, and Marshallians have their moments of reflection, the two systems have inevitably tended to grow back into one another as the years pass by.

This affinity between two writers of different upbringing and obvi-

<sup>1</sup> Born at Évreux, 1834; in 1870, after ten years of journalism, business, and other miscellaneous activities, he became Professor of Political Economy at Lausanne, a position which he held until 1892. His *Éléments d'Économie Politique Pure* appeared in two parts: the theory of exchange in 1874, the theory of production in 1877. (Second edition 1889, 3rd 1896, 4th 1900.) He died in 1910.

<sup>2</sup> A. A. Walras, *De la nature de la richesse et de l'origine de la valeur* (1832).

<sup>3</sup> *Éléments d'Économie Politique Pure*, p. 76. All references to the *Éléments* will be to the *Édition définitive*, i.e., fourth and subsequent editions.

ously very different mental outlook—their simultaneous development of what was then a very new line of thought—looks at first sight surprising, and one feels almost obliged to explain it by the intrinsic excellence of the path they followed: “it seems no honest heart can stray.” Yet in fact there is a clear historical reason for it, one decisive influence we know to have been felt by both. Each of them had read Cournot.

Now although each makes a specific acknowledgement to Cournot, it is in each case couched in very general terms.<sup>4</sup> They each tell us that Cournot showed them how to use the differential calculus in economics, and this may mean much or little. But it is at least striking that certain very significant elements of Cournot’s mathematical economics, going far beyond the mere idea of using mathematical methods, appear in Walras and appear in Marshall.

One of these is of course the demand curve itself (which already implies a resolution to treat economic quantities as if they are continuous variables). But more important, and less obvious, is the conception of perfect competition. Cournot’s analysis, it will be remembered, passed from Monopoly to Duopoly (or Limited Competition), and from Duopoly to Unlimited Competition, which he defined as a state of affairs in which no single producer is able to influence appreciably the prices of the market. It was this last conception (applied to the theory of exchange value generally) which enabled Walras and Marshall to overcome the difficulties which had baffled Jevons, those difficulties which arise from the differences in the wants of different buyers of a particular commodity.<sup>5</sup> In the hands of Walras, this conception of perfect competition was converted into a special technique of using prices

<sup>4</sup> Walras, *Éléments*, Preface, p. viii. Marshall, *Principles*, Preface to the first edition, pp. ix–x.

<sup>5</sup> Cf. Jevons’ ugly and unsatisfactory device of “trading bodies,” which smudges over the distinction between monopoly and competition.

The relation between Jevons’ work and that of Cournot is curious. When he wrote the first edition of his *Theory* Jevons had not read Cournot; but he had read Lardner’s *Railway Economy*, “which treats certain questions of Political Economy in a highly scientific and mathematical spirit. Thus the relation of the rate of fares to the gross receipts and net profits of a railway company is beautifully demonstrated in pp. 286–293 by means of a diagram. It is proved that the maximum profit occurs at the point where the curve of gross receipts becomes parallel to the curve of expenses of conveyance.” (*Theory of Political Economy*, 1st edition, pp. 17–18.) Lardner thus plotted total receipts and total costs against price—a peculiar way of putting it, to our ideas; but it is obvious that in so doing he adopted the most direct way possible of expressing the fifth chapter of Cournot’s *Recherches* in geometrical form. Whether this is really what happened, I am unable to say; all that can be said is that it is definitely possible. For at the time Lardner wrote his book (1850) he was living in Paris, and so was Cournot; and there was at least this link between them, that in 1835, three years before

as economic parameters. Although of course this technique was used by Marshall as well, its very consistent employment is highly characteristic of Walras' work.

With this equipment, it was fairly easy to give an adequate analysis of the simple exchange of two commodities under competitive conditions. (Cournot had confined himself to the selling of products by producers, and did not examine the logically prior problem.) Accordingly, we find Walras beginning his *Éléments* in this way (1874), and Marshall following with a substantially equivalent analysis, hidden under the guise of a theory of International Values (1879).<sup>6</sup>

Walras' treatment fails of complete generality in only one respect; the downward slope of the demand curve is not quite so inevitable an assumption as he thought it. But he was well aware that the downward slope of the demand curve does not necessarily imply that the supply curve derived from it is upward sloping. If a person is buying  $X$ , and giving  $Y$  in exchange, then, if his demand for  $X$  becomes inelastic, his supply curve of  $Y$  will turn back towards the price-axis. In this case it becomes possible that the demand and supply curves for  $Y$  may cut several times; but some of these intersections will be points of unstable equilibrium.

Faced with this difficulty of multiple intersections, Marshall cut the knot by his distinction between the "theory of International Values" and the "theory of Domestic Values." In "International Values," the possibility of negatively inclined supply curves is serious; but they are unlikely to be particularly important in practice, because the competition of domestic industry generally suffices to keep a country's demand for imports in terms of exports fairly elastic.<sup>7</sup> In the theory of "Domestic Values," we may take commodities to be usually sold by producers or dealers who have themselves no direct demand for what they sell. Negatively-inclined supply curves can then only arise from increasing returns.

he wrote the *Recherches*, Cournot had translated a book on Mechanics by Lardner into French.

But if we cannot prove the filiation, so much at least is clear: Jevons started from a theory of monopoly substantially identical with Cournot's. Where Walras and Marshall had the advantage over him was in their possession, not only of Cournot's theory of monopoly, but also of his theory of Unlimited Competition.

<sup>6</sup> *The Pure Theory of Foreign Trade*. There is, I think, no question that Marshall's analysis is quite independent of Walras'. Yet they differ in only two ways: (1) Marshall uses aggregate curves, instead of the simple price-quantity curves used by Walras; (2) Marshall's "Increasing Returns" complication has of course no counterpart in Walras' simpler problem.

<sup>7</sup> This is, indeed, to interpret the early Marshall by the late. (*Money, Credit, and Commerce*, pp. 351-352.)

Apart from the reference to increasing returns (a problem he never seriously examined), this reliance on sale by producers, whose reservation demand is negligible, was Walras' way out also.<sup>8</sup> But before coming to that point, he widened the problem by a consideration of multiple exchange, where more than two commodities enter into the picture. In order to treat this question, he supposed one of the  $n$  commodities to be chosen as a standard of value (*numéraire*), in which prices are reckoned, but which is itself subject to no demand other than that which arises from its ordinary properties as a commodity.<sup>9</sup> There thus remained  $n-1$  prices to determine. From the conditions of given stocks at the commencement of trading, and equalization of the marginal utilities of expenditure in all directions, he derived each individual's demand (or supply) for each commodity. Then the ordinary equations of supply and demand in each market give the conditions of equilibrium. They are  $n$  in number, but that in the market for the *numéraire* is superfluous, as it follows from the rest. There are thus  $n-1$  equations and  $n-1$  unknowns; a set of prices must therefore exist which satisfies the conditions of equilibrium.

Here, for the first time, we have a characteristically Walrasian doctrine. What is it worth? On our estimation of it our view of Walras' individual contribution to economics must largely depend.

Now it is, of course, quite clear that, even when they are applied to this pure problem of exchange, the equations are far too complicated to be of much use in analysing any actual situation. But that is surely not their function. Where they are supremely useful is in elucidating the general way the price-system works, and in giving us a classification of those factors which may be relevant to any particular case. In practice we have to select out of that over-long list those which are most important for each special problem. When that selection is performed, we may get a result which conforms to the simpler scheme employed by Marshall; but on the other hand we may not.

The types of equations used by Walras in determining exchange equilibrium are two; those which express the dependence of the amounts

<sup>8</sup> *Éléments*, p. 163. It may be questioned whether Walras had as much right to it as Marshall (often) had.

<sup>9</sup> "Nous supposons ici les achats et ventes de (A) comme intermédiaire s'effectuant de manière à n'influer en rien sur le prix propre de cette marchandise. Dans la réalité, les choses se passent tout autrement. Chaque échangeur a par devers lui un approvisionnement de monnaie en vue de l'échange et, dans ces conditions, l'emploi d'une marchandise comme monnaie, a sur sa valeur une influence que nous étudierons plus loin." (*Éléments*, p. 156.) Recent economic thought has suffered, I think, by its neglect of this valuable device. The *numéraire* is a fanciful notion, perhaps; but it is the only logical way by which we can suppose exchange (or lending) to take place *in natura*.

demanded and supplied by particular individuals on the system of market prices, and those which express the equality of demand and supply in particular markets. These two classes stand on very different footings. So far as the first class is concerned, they have become the essential foundation for the whole branch of economics to which they refer. On them is based, and had to be based, all the work in the field of demand and of related goods, which has been carried out by Edgeworth, Pareto, and others. In the process of development Walras' conception of utility has been much refined; but we still work with Walras' equations, however differently we write them.

The second class, which expresses the equation of supply and demand in the different markets, seems much more simple and obvious; yet it has proved much more open to criticism. For it is on this class that the meaning of Walras' system of general equilibrium depends, and by far the most important divergence between Walras and Marshall turns on this point.<sup>10</sup>

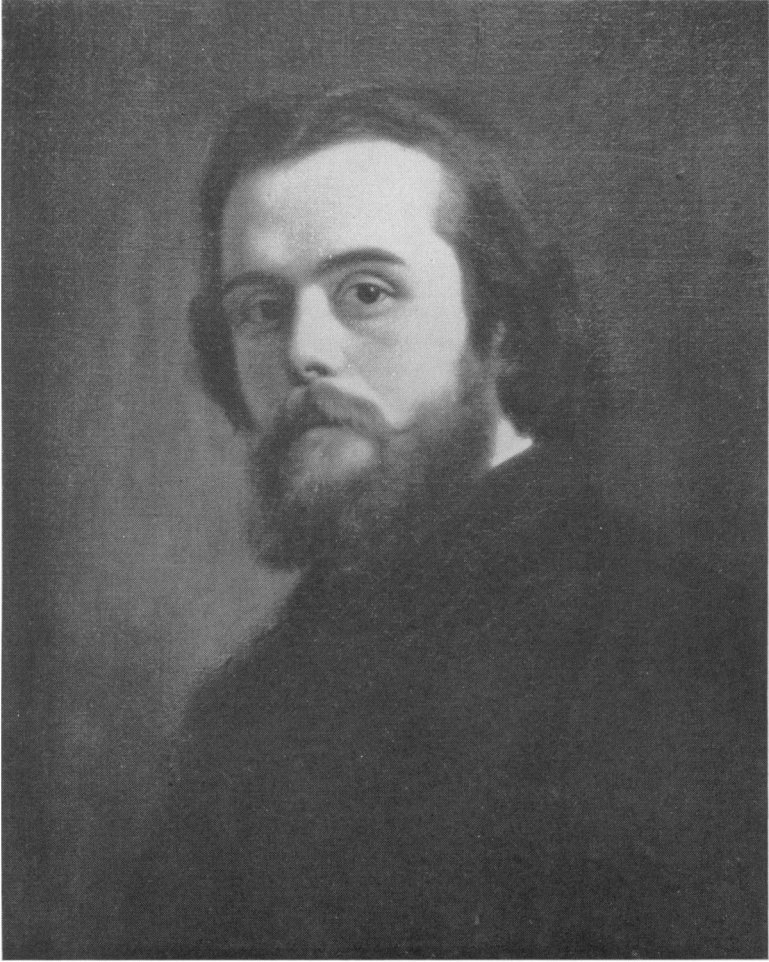
Walras' own account of the nature of equilibrium is this. Persons come on to the market with certain stocks of commodities, and certain dispositions to trade ("dispositions à l'enchère") and a particular set of prices is proposed. If at these prices supplies and demands are equal, then there is equilibrium straight away. But if demands and supplies are not equal, prices will be changed until equilibrium is reached.

What, however, Walras does not make really clear is whether any exchanges do or do not actually take place at the prices originally proposed, when those prices are not equilibrium prices.<sup>11</sup> If there is no actual exchange until the equilibrium prices are reached by bidding, then Walras' argument is beyond reproach on the score of logical consistency, though it may be called unrealistic. (The market then proceeds under Edgeworth's principle of "recontract," or provisional contract.) But if such exchanges do take place, then, in general, the final equilibrium prices will be affected by them.

Marshall's way out of this dilemma was to concentrate on a particular market, where he could show that if the marginal utility of one of the commodities exchanged could be treated as constant, then the final rate of interchange would be independent of the path followed to

<sup>10</sup> Cf. Edgeworth's review of Walras in *Nature* (1889) and his controversy with Bortkiewicz in the *Revue d'Économie Politique* (1890-91). Also his comment in *Papers*, II, 311.

<sup>11</sup> "Les marchés les mieux organisés sous le rapport de la concurrence sont ceux où les ventes et achats se font à la criée, par l'intermédiaire d'agents tels qu'agents de change, courtiers de commerce, crieurs, qui les centralisent, de telle sorte qu'aucun échange ait lieu sans que les conditions en soient annoncées et connues et sans que les vendeurs puissent aller au rabais et les acheteurs à l'enchère." (*Éléments*, p. 44.) This remains ambiguous.



LÉON WALRAS, 1834–1910  
*Aet. 30*

reach it.<sup>12</sup> But this solution—which is, after all, only a very particular solution—is usually not available in the case of General Equilibrium.

Neither Walras nor Pareto faced up to this difficulty; when we do so, it is impossible to avoid the conclusion that the “Lausanne equations” are of rather less significance than they imagined. The equations of Walras are not by any means a complete solution of the problem of exchange; but they remain a very significant step towards such a solution. For Walras’ system of prices will be reached, either if contracts are made provisionally or (a more important case) if people come on to the market on successive “days” with the same dispositions to trade, and there is no carry-over of stocks (or a constant carry-over) from one day to the next. When it is understood in the last sense, the theory of static equilibrium of exchange takes its place as a step towards the development of a complete theory with which future exposition is unlikely to dispense.

## II

From the General Equilibrium of Exchange, Walras passed to the General Equilibrium of Production. For him, as for the Austrians, the problem of production fell into two parts: one relating to the pricing of factors of production, which are only used in combination with one another; the other relating to the rôle of time in production—the theory of capital.

The first of these problems (which corresponds to the Austrian theory of imputation) is really no more than an extension of the theory of value: it studies one particular kind of interrelation of prices. In this field Walras’ original work was chiefly confined to a consideration of that problem which from his point of view is the simplest (though the Austrians naturally found it the hardest from their standpoint); the case where the “coefficients of production” are fixed, so that the quantities of all factors needed to produce a unit of each kind of finished product are technically given.

With fixed coefficients, and with perfect competition, the equilibrium prices of the products must depend on the prices of the factors; thus, given the prices of the factors, the whole price-system (of products and factors) can be derived by simple process of addition. But, given this whole price-system, the demands for products and the supply of factors can be determined from the tastes and abilities of the individuals composing the economy. Again, once the demands for the products are determined, the demands for the factors can be technically deduced. We can thus write both the demands for the factors and the supplies of the factors as functions of the set of factor-prices; and determine

<sup>12</sup> Marshall, *Principles*, Book v, Chapter 2; also the Appendix on Barter.



equilibrium in the factor markets as before. The equilibrium prices in the factor markets now determine the equilibrium prices of the products.

This solution is of course valid only under the assumption of fixed coefficients; but Walras was quite aware that it could easily be extended to the more realistic case of variable coefficients.<sup>13</sup> One cannot help thinking it to be a great pity that he did not trouble to work out this hint, for it would have led directly to the general law of marginal productivity.

Nevertheless, even as it is, this part of Walras' work has great merits. The particular relation which it exhibits has quite general significance, and could hardly have been discovered in any other way than this. Even when the coefficients of production are variable, so that a rise in the price of one particular factor influences the demand for it mainly by encouraging a substitution of other factors within industries, there will still be present this further tendency: that the factors which cooperate with this first factor will find it more profitable to devote themselves to the production of products for which relatively little (or none at all) of the first factor is required.

Again, we have here an excellent illustration of the value of Walras' work for the clearing up of questions of principle—the sort of question which Marshall so frequently left rather confused. Walras' equations give the most exact version that has ever been given of the “opportunity cost” element in value; and at the same time they preserve the essence of the “real cost” principle for which Edgeworth and Marshall contended. They exhibit the supplies of the factors as variable, but as determined by the system of prices in fundamentally the same way as the demands for commodities, with which they are interdependent.

It is hardly necessary, at this date, to discuss at any length that one of Walras' conditions which was so vehemently attacked by Edge-

<sup>13</sup> “Nous supposons, comme on voit, les coefficients . . . déterminés *a priori*. En réalité ils ne le sont pas: on peut employer, dans la confection d'un produit, plus ou moins de tels ou tels services producteurs, par exemple, plus ou moins de rente, à la condition d'y employer moins ou plus de tels ou tels autres services producteurs, par exemple, moins ou plus de profit ou de travail. Les quantités respectives de chacun des services producteurs qui entrent ainsi dans la confection d'une de chacun des produits sont déterminés en même temps que les prix des services producteurs, par la condition que le prix de revient des produits soit minimum.” (*Éléments*, p. 212.) This passage first appeared in 1877. (The condition of minimum cost follows from that of maximum profit—under conditions of perfect competition.) For Walras' later work on Marginal Productivity, see particularly his “Note sur la réfutation de la Théorie anglaise de fermage de M. Wicksteed,” which appeared as an appendix to the third (1896) edition of the *Éléments*, but was subsequently omitted.

worth<sup>14</sup>—the condition that prices equal costs of production, so that the entrepreneur makes “neither profit nor loss.” For this device, in spite of its paradoxical appearance, is nothing else than the reckoning of “normal profits” (the profits which the entrepreneur could earn in other activities) into costs; and similar forms of definition are now adopted for their extreme convenience by many economists who would acknowledge no direct debt to Walras.<sup>15</sup> It may indeed be questioned whether the full implications of this method of statement have been explored—particularly with respect to its application to dynamic conditions. But the device itself needs no defence nowadays.

### III

Those parts of Walras’ doctrine which we have hitherto considered are on the whole uncontroversial; it is true that they raise difficult problems of interpretation, but no one seems to doubt that in some sense they are valid enough. It is these parts which have passed into the body of economic teaching; and when we want to study them we are inclined to go, not to Walras’ own works, but to the rather more elegantly stated versions of his successors, such as Pareto or Wicksell.

Walras’ theory of capital, however, has not reached this happy position. By Pareto it was simply ignored; by Wicksell it was attacked.<sup>16</sup> It has therefore not passed into any recognized “Lausanne” tradition, and is liable to be dismissed as something of an aberration. In spite of this, it has its merits; though there can be no question that it needs a good deal of repair in details before it can become a usable theory.

If a reader who is acquainted with the work of Böhm-Bawerk<sup>17</sup> and Wicksell approaches Walras’ theory of capital, the first thing which will strike him is that it is purely a theory of fixed capital. Walras begins from a discussion of the capital value of income-yielding goods. He shows that the ratio of capital value to net income yielded (after allowance for depreciation and insurance) must tend to equality for

<sup>14</sup> Edgeworth, *Papers*, I, 25.

<sup>15</sup> E.g. Robinson, *Economics of Imperfect Competition*; Keynes, *Treatise on Money*.

<sup>16</sup> Wicksell, *Über Wert, Kapital und Rente*, pp. 142–3. Barone (“Sopra un libro di Wicksell”—*Giornale degli Economisti*, 1895) replied to some of Wicksell’s criticisms, and apparently convinced him that he had overstated his case. Wicksell’s comments in his *Lectures* (English edition, I, p. 171) are appreciably milder; while in his late paper “Professor Cassel’s Economic System” (reprinted in the English edition of the *Lectures*, p. 236) he takes what I should consider a very balanced view.

<sup>17</sup> Walras’ theory is of course earlier in date than Böhm-Bawerk’s; it was substantially complete by 1877.

all such goods; otherwise people would sell the more expensive (relatively to yield) and buy the cheaper. Thus there emerges a "rate of net yield" (*taux du revenu net*), which, in equilibrium, must be equal for all capital goods.

How is the "rate of net yield" determined? By the condition that the prices of new capital goods must equal their costs of production. Granted that a certain amount of new saving is coming forward, this saving will give the demand for new capital goods.<sup>18</sup> The saving has then to be divided among the various capital goods that can be produced in such a way as to maximize the rate of net yield.

Substantially, that is Walras' theory; it is a theory, which, if taken literally, is open to very serious objections.

For one thing, as Wicksell pointed out, it determines the rate of interest on the market for new capital; and is therefore apparently inapplicable to stationary conditions, when no net addition to the capital equipment of the community is being made. Further, as Walras would have realized if it had not been for his confusion about the exact meaning of equilibrium,<sup>19</sup> it is only in a stationary state that we can get any sensible sort of equilibrium, so long as people expect the prices of products to remain unchanged in the future (as Walras tacitly assumes they do). This dilemma is fatal to the theory as Walras presents it.

But it is not necessarily fatal to the whole method of approach. For once we assume that the reinvestment of depreciation allowances is not technically given (in the way Walras supposed), but that these funds are reinvested according to the best prospects open for them at the moment of reinvestment; then the "new capital goods" become not only net additions to the capital stock, but also replacements, and the demand for these goods is no longer confined to new savings, but consists of depreciation allowances as well. With this slight extension, Walras' system becomes immune from Wicksell's criticisms; the capital market does not disappear in the stationary state.<sup>20</sup>

<sup>18</sup> Savings are of course also a function of the rate of net yield, which now enters into the determination of expenditure on the same footing as the prices of commodities. It must be remembered that savings are expressed in *numéraire*.

<sup>19</sup> The confusion we discussed above. It gets palpably worse in the later part of Walras' work. See, for example, the rather pathetic passage on pp. 214–215 of the *Éléments*.

<sup>20</sup> It is interesting to observe that, once this amendment is made, the limitation due to Walras' concentration on fixed capital disappears. For the method of reducing fixed capital to circulating, introduced by Jevons and Böhm-Bawerk, works both ways. If a machine is economically identical with a collection of half-finished goods which will be ready at different dates, so is a collection of half-finished goods economically identical with a machine.

Walras did not make this amendment, but its possibility deserves attention; for it shows the essential rightness of his method, which survives the imperfect way in which he used it. Once the amendment is made, Walras' theory of capital becomes as good as Wicksell's, and better than Böhm-Bawerk's. It is still subject to the static limitations within which their theories are also confined, but it is as good a basis for extension in a dynamic direction as theirs—and in some ways it is perhaps better.<sup>21</sup>

#### IV

Walras' work on the theory of money,<sup>22</sup> and his relatively uninteresting writings on applied Economics, cannot detain us here. It was in pure economics that his real interest lay, and the discovery of the conditions of static equilibrium under perfect competition was his central achievement. Like many pioneers, he was a little vague about the exact meaning of some of his results, and was perhaps inclined to claim for them more than they are actually worth. Yet our consciousness of its limitations should not blind us to the greatness of his achievement. Static equilibrium is far from being the whole of economics, but it is an indispensable foundation; and the greater part of that foundation was laid by Cournot and Walras. There are very few economists who have contributed so much to the permanent body of established truth as Walras did.

Comment may be made in conclusion on two qualities of his work taken as a whole. One is the realization of the unity of economic life which emerges so forcefully from his pages. Other economists had had a sense of this unity, but none before had shown it so well. For the unity which Walras demonstrated is not a unity of resources being allotted among a single system of ends—the only unity which really appears in Menger—it is a unity of diverse individual ends reconciled through the mechanism of the market. Yet this unity is as real as the other. In a free economic system, under perfect competition,

thou canst not stir a flower  
Without troubling of a star.

The other great quality of Walras' work to which we may here allude is its rigorous "methodological individualism." Far better than any earlier economist—better even than Marshall—he realized that the

<sup>21</sup> The "original factors" of the Austrians, being largely "bygones," are a thorough nuisance in economic dynamics.

<sup>22</sup> See Marget, "Léon Walras and the Cash-Balance approach to the Problem of the Value of Money" (*Journal of Political Economy*, 1931). In this field Walras did at least make a serious attempt to integrate monetary theory with the rest of economics; he did something to prepare the way for Wicksell.

only economic explanation of a phenomenon is its reference back to individual acts of choice. Even he did not emancipate himself entirely from that sham utilitarianism which was the bane of his contemporaries, and which led them to suppose that the working of the free market "maximized utility" for the community as a whole.<sup>23</sup> But this in his work is a mere excrescence, and is easily disregarded. In his central doctrines he held firmly to the true significance of economic subjectivism, and therefore broke with the Labour Theory of Value more drastically than Marshall, and quite as drastically as the Austrians.<sup>24</sup> For him individual choice was all-important in its function as explanation; and it is our realization of this which has led us to understand that it is not, for the economist, necessarily anything more.

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<sup>23</sup> Cf. Wicksell's final exposure of this fallacy (*Lectures*, I, pp. 73 ff.).

<sup>24</sup> If he was less conscious of this principle than they were, he wove it even more tightly into the structure of this theory.