



Pareto and Pure Economics

Umberto Ricci

The Review of Economic Studies, Vol. 1, No. 1. (Oct., 1933), pp. 3-21.

Stable URL:

<http://links.jstor.org/sici?sici=0034-6527%28193310%291%3A1%3C3%3A%3A%3E2.0.CO%3B2-5>

The Review of Economic Studies is currently published by The Review of Economic Studies Ltd..

Your use of the JSTOR archive indicates your acceptance of JSTOR's Terms and Conditions of Use, available at <http://www.jstor.org/about/terms.html>. JSTOR's Terms and Conditions of Use provides, in part, that unless you have obtained prior permission, you may not download an entire issue of a journal or multiple copies of articles, and you may use content in the JSTOR archive only for your personal, non-commercial use.

Please contact the publisher regarding any further use of this work. Publisher contact information may be obtained at <http://www.jstor.org/journals/resl.html>.

Each copy of any part of a JSTOR transmission must contain the same copyright notice that appears on the screen or printed page of such transmission.

JSTOR is an independent not-for-profit organization dedicated to creating and preserving a digital archive of scholarly journals. For more information regarding JSTOR, please contact support@jstor.org.

Pareto and Pure Economics^{*}

By UMBERTO RICCI

(Gizeh University, Cairo)

FOREWORD

I AM delighted to agree to the suggestion of the editors of the REVIEW OF ECONOMIC STUDIES to publish a translation of my article on "Pareto and Pure Economics" in their first number. Vilfredo Pareto was without doubt one of the great thinkers of his day. He left his mark on many branches of learning, as a mathematician, economist, statistician and sociologist. My article was written for a number (January-February 1924) which the *Giornale degli Economisti* wished to devote to Pareto's memory. It was concerned only with an examination of Pareto's work in the field of pure economics. To others fell the task of evaluating the remaining aspects of his intellectual life. Though written some time ago the article may stand to-day. Walras had provided a powerful synthesis of pure economics. Pareto, as Walras' successor at Lausanne, completed and refined the Walrasian system, giving to it a comprehensiveness it would be hard to surpass. Since Pareto's death some practical work, somewhat on the lines which he might have followed, has been undertaken (cf. H. L. Moore, *Synthetic Economics*, and my review in the *Zeitschrift fuer National Oekonomie*, Bd. 1, Heft 5). Such an attempt can hardly avoid heaping difficulty upon difficulty.

The Walras-Paretian system remains nevertheless a very great achievement. If it cannot be applied directly to concrete problems, it is, however, a most useful mental tonic to the inquirer, keeping him constantly on the alert to perceive possible connections between phenomena and putting him on his guard against excessive particularity and empiricism. Such a combined picture of consumption, production and exchange is indeed a true work of art.

May 1933.

UMBERTO RICCI.

I. EQUILIBRIUM IN THE CLASSICAL ECONOMISTS

1. The concept of Equilibrium was already present, in embryo, in the theories of the Classical School.¹ On what, they asked, does the value of commodities depend? We must distinguish according as to whether free competition is operative or not.

^{*} This article originally appeared in the *Giornale degli Economisti*, 1924, under the title "Pareto e l'economia pura." We are indebted to the editor of the *Giornale* for permission to publish this translation.—ED.

¹ The Classical theory of value (substantially that of Mill and Cherbuliez, but with some further improvements), is set out in the works of E. Nazzari, first in his fine essay on the *Rent of Land* (1872), and later in his *Résumé of Political Economy* (1873). The latter book is still used by Italian students.

(a) In the first case there is a *market* value which oscillates continually about the *normal* value, moving up and down according as demand is greater than supply, or supply than demand. Of these two, demand is related to utility, and supply to facility of acquisition. These oscillations of market about normal value correspond exactly to the modern conception of equilibrium. To what is *normal* value which thus determines the position of equilibrium equal? To *cost of production*. This is the maximum cost (to-day we should say marginal cost), when different costs of production exist simultaneously; and that is always the case when production is not indefinitely extensible. Cost of production can then be split up into wages and profits.

The equilibrium which is achieved through the equation $price = cost$ is *stable*. If it is disturbed certain economic forces are immediately set in motion, which tend to re-establish it. These forces are the profits and losses of entrepreneurs.

(b) In the case of monopoly everything depends on the play of supply and demand; cost of production indicates minimum value only, not normal value. At the time when Mill was writing his *Principles*, a developed theory of monopoly was already in existence. As early as 1838 Augustine Cournot had pointed out that when demand is given as a function of price, the point of equilibrium is exactly determined, being that which gives the entrepreneur his maximum net revenue. But Cournot's work was for many years neglected.

2. Returning to the Classical account, we find that the wages and profits which formed the indispensable ingredients of every cost of production had their own laws. There was a *normal* wage determined by the standard of living of the workers, and a *market* wage oscillating about the former as the demand for and supply of labour varied. Here again the picture is drawn in terms of equilibrium. Profit was conceived as the difference between the productivity of the industry and the wage, previously determined by its own law. Beyond this the classics adumbrated a law or tendency towards the equalisation of profits in different industries—which necessarily presupposed an interdependence of the productive system as a whole. Rent finally was defined as an extra profit accruing to the owners of land of superior fertility or proximity to the market. It was thus rigorously determined as the difference between two costs.

II. MARSHALL'S THEORY OF PARTIAL EQUILIBRIUM.

3. In the exposition of the Classical School the analysis of utility was absent. The discovery of the antithesis between total and final utility—due to several independent thinkers—and, more important still, the refinement of the concept of final utility through the infinitesimal calculus, ushered in a remarkable step forward in economic science. This is particularly connected with the names of Gossen and Jevons—and also those of Menger and Walras. In the study of productivity—or the indirect utility of the factors of production—the use of the infinitesimal analysis

achieved a completeness similar to that which had in the same manner been introduced into the analysis of the direct utility of consumers' goods.

The co-ordination of the new theories with those of the classics was the work of Marshall. In the writings of that great economist the concept of equilibrium took a new and brilliant form. His apparatus of intersecting demand and cost curves succeeded in defining and determining both stable and unstable equilibrium. He reduced all possibilities of economic advantage, in a régime of free competition, to his two categories of producers' and consumers' rent.

Thus he was able to complete a picture of which no more than the scanty and primitive outlines were traceable in Gossen's intersecting curves of utility and painfulness (1853). Other graphic representations, which were more genuinely curves of demand and supply, had been used by Jevons (1862) and Jenkin (1870), but no one else had achieved the fullness of Marshall's treatment. For him the foundations of demand and supply were final utility and cost respectively; and thus he settled the outworn dispute between those who deduced value from cost and those who related it to final utility.

4. Equilibrium in Marshall's theory was, however, always *partial* equilibrium. The price of a commodity is made to depend exclusively on the demand for and the cost of production of that particular commodity. It is true, that in order to draw the demand curve of any individual for any particular commodity it is necessary to know the final utility of money to that individual, since this forms the link between his different lines of consumption. It is similarly true that the cost of a unit of product can be resolved into the prices of the factors multiplied by the respective *coefficients of production*, and thus all lines of production are linked together—but in Marshall's work these links receive little attention.

The standard versions of Marshall's theory of partial equilibrium are to be found in two essays printed for private circulation in 1879—*The Pure Theory of Foreign Trade* and *The Pure Theory of Domestic Values*; and in his two well-known books, *The Economics of Industry* (1879) and *The Principles of Economics* (1890).

III. WALRAS' THEORY OF GENERAL EQUILIBRIUM

5. At the time that Marshall was assembling the materials for his theory of partial equilibrium, a more powerful synthesis was beginning to take shape in the mind of Léon Walras.

Reduced to its fundamentals, Walras' system may be summarised in the following propositions, each of which points out a particular kind of link.

(i) *The Budget of the individual consumer-producer.* Each individual sells productive services, namely uses of the factors of production, and buys consumers' goods. The sum of money which he receives from the sale (a sum equal to his *supplies* of services multiplied by their respective prices), less the sum which he spends (equal to his *demands* for consumers'

goods multiplied by their respective *prices*) is his individual *saving*. This saving is expressed in money or "numéraire." To say that one good is the "numéraire" is equivalent to saying that there is one good the price of which is always equal to unity.

The supply of saving may be expressed, according to Walras, as a demand for a *perpetual net income* divided by the rate of interest. In his notation, money alone produces *interest*. The price of the use of a unit of money during a unit of time is called the rate of interest. The factors of production do not yield interest but a *net product*, that is, the price of the service they render less amortisation and insurance quotas.

(ii) *Maximum individual satisfaction*. Each individual reaches his own individual equilibrium when the *final or marginal utility* (called by Walras *rareté*) of each consumption good divided by its price, and the marginal disutility of each productive service subject to cost, divided by its price, give the same quotient. This quotient must also equal the marginal utility of the perpetual net income multiplied by the rate of interest.

If we assume that the prices of consumers' goods and of productive services, and also the rate of interest, are known, these two first groups of relations or equations already enable us to determine the *individual demands* for consumers' goods, and also the *individual supply* of productive services and saving. By the addition, separately, for every sort of good and service, and for saving, of the individual demands or individual supplies, we can immediately obtain the *collective* demand, or alternatively the *collective* supply.

It will be already evident at this point that the quantity of a consumers' good demanded in a market is a function of all prices; should there be a change in the price of any consumers' good whatever or of any productive service whatever, or again in the price of the use of money, each individual must remake his budget and more or less replan his entire demand. The same is true of the quantity of services and of saving he will offer.

(iii) *The Entrepreneur's budget*. To produce one unit of a consumers' good it is necessary to combine the various productive services in certain definite proportions. Once these necessary quantities—the coefficients of production—are known (and for the moment we may suppose them to be given), and once the prices of the services are known, the expenses or costs of production for each unit of product are completely determined. In a régime of free competition the price of the product is taken as equal to the expenses incurred by the entrepreneur—the *cost of production*. We obtain thus a third group of relations or equations; they are just the equations of the budgets of the entrepreneurs.

It is the business of a particular category of entrepreneur to transform saving into instruments and factors of production (which Walras calls without distinction, "capitaux"). For these entrepreneurs the law, "price=cost" is translated into another law, "saving is divided among the various industries which transform it, in such a manner that in every

industry the net product (produit net) of the factors of production divided by the prices of the factors, equals the rate of interest."

(iv) *Elimination of the prices of consumers' goods and of the prices of the services of capital goods from the equations of collective demand and supply.* Let us for a moment look at the set of equations (III) which express the law, "price=cost." This set enables us to express the prices of consumers' goods as a function both of the prices of services and of the rate of interest, and from this we obtain the prices of services of *produced* "capitaux," as a function of the prices of the services of non-produced "capitaux," and of the rate of interest. Then by eliminating the prices of consumption goods and of services of produced capital between this third set of equations and the equations of collective supply and demand obtained from the first two sets, we can represent the whole collective demand for consumers' goods, which we call $D_a, D_b \dots$ as a function of the prices of the services of non-produced factors, $p_x, p_y \dots$ and of the rate of interest i . Thus we obtain :

$$[1] \begin{cases} D_a = f_a(p_x, p_y \dots i) \\ D_b = f_b(p_x, p_y \dots i) \\ \dots \dots \dots \end{cases}$$

We can deal similarly with the collective supply of the services of non-produced "capitaux" and of saving. Then, indicating the collective supply of the services of non-produced factors $x, y \dots$ by $S_x, S_y \dots$ and by S_u , the supply of saving, we obtain

$$[2] \begin{cases} S_x = \phi_x(p_x, p_y \dots i) \\ S_y = \phi_y(p_x, p_y \dots i) \\ \dots \dots \dots \\ S_u = \phi_u(p_x, p_y \dots i) \end{cases}$$

(v) *Collective demand for services and saving.* Now to produce the quantities $D_a, D_b \dots$ of consumers' goods demanded collectively by the whole community, determinate quantities of services and of saving are required, since we are supposing the amount of the various services needed to produce a unit of each product (*the coefficients of production*) to be given and fixed. These total requirements give us the demand for savings D_u coming from those entrepreneurs who transform the saving into new "capitaux"; and the demands for services $D_x, D_y \dots$ coming from those entrepreneurs who transform the services of non-produced factors into consumers' goods.

And since we have already expressed the demands for consumers' goods ($D_a, D_b \dots$) as a function of the prices of the services of the non-produced factors and of the rate of interest (equation [1]) it follows finally that the demands for these same services and for saving can be expressed as a function of the prices of the services of non-produced factors and of the rate of interest only. Thus we obtain :

$$[3] \begin{cases} D_x = \psi_x (p_x, p_y \dots i) \\ D_y = \psi_y (p_x, p_y \dots i) \\ \dots \\ D_u = \psi_u (p_x, p_y \dots i) \end{cases}$$

(vi) *Equalisation between the collective demand for and supply of services and saving.* Under the assumption that the prices of services $x, y \dots$ and the rate of interest are already known, we have seen that the total *supply* of those services and of saving (equation [2]) will be determined. We now perceive that the respective *demands* (equation [3]) are also determined. But if the prices $p_x, p_y \dots$ and i are arbitrarily fixed, the demands will not come out equal to the supply. We must then proceed by trial, i.e. by moving and altering the prices and the rate of interest, until the *collective demand* for each service *becomes equal to the respective supply*, and likewise the collective demand for saving becomes equal to the supply; in other words we have to solve the system of the equations.

$$\begin{aligned} \phi_x &= \psi_x \\ \phi_y &= \psi_y \\ &\dots \\ \psi_u &= \phi_u \end{aligned}$$

The system is perfectly determined, because if there are “ n ” original “capitaux” or factors, and therefore “ n ” *productive services* $x, y \dots$ (each species of capital or factor gives a particular kind of service) the unknowns are $n+1$, namely the n prices of the services and the rate of interest. The equations are likewise $n+1$.

When the system is solved, i.e. when $p_x, p_y \dots i$ have been found, we can immediately calculate the prices of $p_h, p_k \dots$ of the produced “capitaux” and finally the prices of consumers’ goods. Similarly we can calculate the demands for services, for goods and for saving which will equal their respective supplies. Knowledge of the system is then complete; equilibrium demand, equilibrium supply and equilibrium prices are all known.

(vii) *Variability of the coefficients of production.* For simplicity we have hitherto supposed that the coefficients of production are known and fixed. In fact they are variable. We have then to discover the productivity function, that is, we must learn how the quantity of a certain consumers’ good produced varies when the quantities of the various services necessary to its production vary. Then by adding a small amount to the quantity of *one* service and leaving all the others unchanged, we shall see what is the corresponding increment in the quantity of the product, and we shall be able consequently to calculate the quotient obtained by dividing this second variation by the first. The quotient is simply the *marginal productivity* of the service which has been varied in quantity. In analytical language it is the partial derivative of the productivity function in respect of the service which we suppose varied.

In the system of equations of economic equilibrium, it is sufficient to substitute for the fixed coefficients of production these new quotients (the partial derivatives) in order completely to take account of the variability of the coefficients of production.

6. This in brief is the theory which step by step took form in the mind of Léon Walras. When it was finished its contemplation must have afforded him the same æsthetic satisfaction as thrilled Ricardo when he first perceived and worked out the law governing the international distribution of money. Both are among the most remarkable creations of the human intellect.

The mutual dependence of economic phenomena is not only clearly displayed, but can be seen in motion as it were in the Walras theory.

The concept of the mutual dependence of reciprocal actions and reactions between Demand, Supply and Price was already implicit in J. S. Mill's *Principles*: "Value depends upon the ratio between the effectual demand, and the supply. . . . But the quantity demanded is not a fixed quantity, even at the same time and place; it varies according to the value; if the thing is cheap there is usually a demand for more of it than when it is dear. The demand therefore partly depends on value. But before it was laid down that the value depends on the demand. From this contradiction how shall we extricate ourselves? How solve the paradox, of two things each depending upon the other?"²

But what an advance from the *Principles* of Mill to the *Economie politique pure* of Walras!

7. The complete theory of equilibrium was not conceived by Walras in an instant, but was developed step by step. In 1873 he read to the Academy of Moral and Political Sciences in Paris a first paper, *Principe d'une théorie mathématique de l'échange*. In this he showed how equilibrium prices are derivable from the demand curves; these in their turn from the utility or "wants" curves. The last he also called curves of "rareté" indicating thus the marginal intensity of need satisfied. This first paper with another on the *Equations de l'Echange*, was published at Lausanne in 1874, under the title of *Eléments d'économie politique pure, ou théorie de la richesse sociale*. The second part of this work appeared in 1877, and contained two papers, *Equations de la Production*, and *Equations de la capitalisation et du crédit*, already delivered the preceding year to the Société vaudoise des Sciences naturelles. The systematic volume under the title, *Eléments d'économie politique pure*, was published in 1879, and the definitive edition appeared in 1900.

IV. THE COURS OF VILFREDO PARETO.

8. Pareto had been concerned with economic problems as a railway engineer. In March 1876, the Adam Smith Society held in Florence six public lectures concerning the eventual taking over of the railways by the State; and at this conference Pareto took an active part. On March 26th

² Mill, *Principles*, Book III, chapter 2, paragraph 3. (Ashley's edition, p. 446.)

he gave a lecture opposing State management, which can still be read on pages 17-24 of the little volume, *Il riscatto dell' esercizio delle strade ferrate*, which is an extract from the *Economista* of Florence. Pareto was a fairly regular contributor to the *Economista* at this time.

In the proceedings of the "*Reale Accademia dei Georgofili*," we find four contributions by Pareto dedicated respectively to "The Logic of the New Economic Theories" (1877); to "The Minimum Wage" (1886); to "The Recrudescence of Protectionism" (1886); and to "the Unpopularity of Political Economy" (1889).

He recognised that he owed much to Pantaleoni. This he acknowledged in the *Cours*, and he repeated it explicitly in his article, "*Economia dimessa*" ("Neglected Economy") published in the *Libertà Economica* in 1912. "Pantaleoni has worked steadily to make the scientific study of economics familiar in Italy. I, less than any other can deny this, since it is to his influence that I owe my studies in mathematical economics. I had read the works of Walras, but I had abandoned the gold to devote my attention to the sterile rock—namely to metaphysical considerations. Driven back from these, since they seemed to me then, and still seem to me now, somewhat absurd, I had no confidence that such theories could have a place in an experimental science. But after having read Pantaleoni's *Principles* I modified my opinion. I turned to the works of Walras, and I found therein true gold, namely the concept of economic equilibrium. Being thus established on the right road, I hope that I have worked out some theories which in rigorousness approach those which now rule in the natural sciences—theories which may serve until other people evolve new tools, similar in character but finer; thus we shall go on as long as our science makes progress."

In the *Giornale degli Economisti* there appeared in 1890 and the following years various important articles by Pareto. It will suffice to notice among them his "*Considerazioni sui principi fondamentali dell' economia politica pura*" (1892-3).

9. Pareto's masterpiece, however, is the *Cours d'économie politique professé à l'université de Lausanne*, the first volume of which appeared in 1896, and the second in 1897. It is a pity that Pareto, because he believed that he had progressed beyond this stage of analysis, was never willing to reprint it. The *Cours* is a classic treatise which deserves republication without alteration.

There are not many works of contemporary economic literature worthy of comparison with it, either in the field of pure theory or in that of applied economics and sociology. It has a wealth of statistical data, is magnificent in style and every page is of note. The mere collection and amplification of the footnotes would constitute a valuable treatise on mathematical economics.

Limiting ourselves to the more theoretical and general part of the *Cours*, we must first make a rapid comparison of Walras' exposition with that of Pareto. Walras tended to be prolix. Pareto compressed his matter while developing it much more elegantly and neatly. He was

at the same time a better mathematician and a finer stylist than Walras. Endowed with these qualities he achieved a readable popularisation of Walras' work. Without Pareto, the Theory of General Equilibrium, of which Walras was without question the real founder, would never have acquired the fame which it has now, nor indeed would it have been possible to speak of the Lausanne School.

Pareto was not merely the succesful populariser; he was also the accomplished developer and perfecter of equilibrium theory. He brought it to a degree of complexity which renders it difficult to the minds of even the most able economists.

We must now examine the way in which he filled out and completed the work of the earlier writer.

10. The "rareté" of Walras is a function of one variable only. Tell me what good is consumed by Primus, and I, knowing the psychology of Primus, will be able immediately to calculate what pleasure he will draw from the marginal increment of the good consumed. Pareto, proceeding from this and taking up a concept of Edgeworth's (1881), established more correctly that the "ofelimità elementare," namely the unit pleasure that an individual draws from the consumption of a small increment of a good, when the individual has already consumed a certain quantity of that and of other goods, is a function of the quantities of all goods consumed.

On the subject of "ophelimity," a word introduced by Pareto, there has been much discussion. Some for philological reasons would have preferred the word, "ophelimity"; some, content with the old term, *subjective utility* or *pleasure*, would gladly have avoided the introduction of a new word. Certainly his term was never widely used and has been in fact confined to Pareto and a few of his most faithful followers. It will probably remain a mere curiosity in the history of our science, in the company of other strange words such as catallactics, chrematistics and others.

Leaving the question of words and turning to the substance, there is no doubt that Pareto was right. Strictly all goods are complementary. Not only do I get a different pleasure from sipping coffee according as there is more or less sugar in it, or according as to whether the cup is pottery or porcelain, but I am also affected by the attractiveness of the place where I drink; whether it is well lighted and heated, etc.

The consequence is that in the equations of economic equilibrium, there appear partial derivatives of total utility or of total ophelimity, analogous in so far as they are partial derivatives, to those which Walras had calculated to express marginal productivity. Marginal utilities "ofelimità elementari" are the partial derivatives of the integral function of the pleasure that an individual draws from the consumption of a collection of goods, and the variables are the quantities consumed or possessed. It is observed that this integral function may be non-existent.

Pareto himself did not wish to stress this correction too much. In the *Cours* (par. 25 note) he wrote, "As an approximation, we may suppose

that the elementary ophelimity of a good depends only upon the quantity of that good consumed." He reaffirmed later in the *Manuale* (pp. 241 and 243) that if the variations are small we may consider, "the ophelimity of a good as dependent exclusively on the quantity of that good," namely as a function of one variable only.

11. The theory of *marginal productivity* was also brought to greater perfection by Pareto. He observed that it is as much a mistake to hold the coefficients constant as to hold them variable. Some of them are constant or almost so, others vary with the quantity of the product; others finally are variable in a special way, namely, are bound together in such a manner that the increase of one may compensate for the diminution of another (*Cours*, pars. 714 and 719). (Compare also *Manuel*, p. 631, par. 101).

Barone, in his lucid *Principii di economia politica* (par. 8) paraphrased this concept and treated it more fully. "Of the different coefficients of manufacture some are constant (the quantity of a certain mineral, for instance, necessary to obtain a kilogram of metal), others within certain limits are variable but in inverse proportion to the quantities produced (general, fixed expenses), others are such that an increase of some may compensate for a diminution of others (machines and workers, for example)." He ventured to draw a plane figure measuring on the abscissa the quantity produced and on the ordinate the *total* cost of production. Thus he was able to draw a curve having at the zero point on the abscissa a positive ordinate, and which from that point onwards continually increased, being first concave to the axis of the abscissa and afterwards to that of the ordinate. This is an excellent construction which gives rise to interesting speculations, which have, however, chiefly been worked out along the lines pursued by Marshall and not by Pareto, who was opposed to the construction of plane cost curves.

12. We have already seen that Cournot was the founder of Monopoly Theory. But his analysis holds only within the ambit of particular equilibrium, that is, with reference to a single good. It was not that Cournot lacked the vision of general equilibrium. He had, indeed, a remarkably developed conception of equilibrium for his time. For instance, he wrote in 1838:

"So far we have studied how, for each commodity by itself, the law of demand in connection with the conditions of production of that commodity, determines the price of it and regulates the incomes of its producers. We considered as given and *invariable* the prices of *other commodities* and the incomes of *other* producers; but in reality the *economic system is a whole of which all the parts are connected and react on each other*. An increase in the income of producers of commodity A will affect the demand for commodities B and C, etc., and the incomes of their producers, and, by its reaction will involve a change in the demand for A. It seems, therefore, as if, for a complete and rigorous solution of the problems relative to some parts of the economic system, it were indispensable to take the entire system into account . . .

it must be the case, *that a disturbance experienced by one element of the system makes itself felt from that to the next, and by reaction throughout the entire system* " (pp. 127 and 130).³ In spite of all this Cournot was not able to proceed along the true path of general equilibrium; that was to open only to Walras.

But Walras stopped short after writing down the equations which determine the equilibrium in a régime of free competition. For Pareto was reserved the further synthesis. He succeeded in co-ordinating that theory of monopoly which in the work of Cournot already formed a substantial achievement, or, more exactly, he fused it into the Walrasian theory of general equilibrium.

13. Generalising from doctrines already enunciated by various authors, Pareto showed that rent is a phenomenon of *dynamic* economics, that is, it arises when we pass from one *equilibrium* to *another* (we recall the Ricardian passage from more fertile to less fertile lands). Once this alteration of equilibrium has taken place, it can be calculated in what direction and in what proportion, on the average, the prices of the produced factors of production in a régime of free competition will have varied. Let us suppose a variation in the same manner and same proportion in the price of a factor of production *withdrawn from free competition*, and let us apply the new rate of interest on saving to the new price thus calculated. In this way we obtain a *theoretical* return for a factor withdrawn from competition. The difference between the *theoretical* return and the actual return is the rent, positive or negative, of that factor.

14. By his work on monopoly, Pareto had already notably enriched the Theory of Economic Equilibrium. Not content with this, he also wished to study a collectivist régime, simplifying the problem so far as to show that production would be oriented in the same direction (that is, that the "coefficients of production" would be the same), both in an individualistic society, where free competition reigned supreme, and in a socialistic society, where all the productive services would be concentrated in the hands of an omnipotent minister of production, who would endeavour to achieve the *maximum collective ophelimity*; or in ordinary language, the maximum satisfaction of the wants of the individuals belonging to the collectivity. This is another way of saying that perfectly free competition produces maximum social utility.

It would be a rather naïve deduction to conclude in favour of a collective organisation of society for no better reason than that equation 10 on page 94 of the second volume of the *Cours* has the same result as equation 2 on page 89 of the same volume. The minister of production in a socialist State might find himself in such a parlous condition that not only the true inconveniences of free competition, which are by themselves substantial, but also those attributed to free competition, which are far greater than the true ones, would appear negligible. This might occur, because savings would immediately have a tendency to shrink; because

³ Cournot, A., *Researches into the Mathematical Principles of the Theory of Wealth*. Translated by N. T. Bacon. Macmillan. New York. 1929.

the supply of labour would contract ; because the bureaucracy of the socialist ministry of production would be much more numerous than all the managerial staffs of a liberal State ; and the collective enthusiasm of the bureaucrats behind the minister of production, even if more noble than the spirit of gain animating private entrepreneurs, would hardly have the same productive results.

Certainly, if the reliability of the workers and savers is not changed by the establishment of a collectivist State ; if the minister of production knows as much as the private entrepreneurs in a liberal State know ; and if he has the force to carry out all that these same entrepreneurs carry out ; the results would be the same in both régimes ; but this is an empty conclusion.

Finally (as Pareto himself, in the end, explicitly remarks, for example, par. 1,022), the incomes assigned by the minister of production will not as a rule coincide with those which occur in a régime of free competition. This would be sufficient to bring it about that even supposing that the identity of production were reached by means of a number of unrealisable hypotheses *in a first period*, that identity, at the beginning of a second period, would encounter an altered distribution of wealth. Hence, in the second period, the equilibrium achieved in the collectivist régime would be very different from that obtained in a régime of free competition.

V. THE "MANUALE" AND THE LATER WORKS.

15. In the *Manuale di Economia politica* (1906), which had been previously announced in an essay in the *Giornale degli Economisti* ("Summary of chapters of a new treatise on pure Economics," March and June 1900) ; in the rewritten appendix to the *Manuel d'Economie politique* (1909) (the French translation of the *Manuale*) ; in the article, "Economie mathématique" (1911) (a complete and unrecognisable rewriting of the article "Anwendung der Mathematik auf Nationalökonomie," which he wrote for the *Encyclopädie der Mathematischen Wissenschaften* in 1902, which was translated into Italian by Sensini, and published in the *Giornale* in November 1906), Pareto succeeded in giving an ever greater generality to the Theory of Economic Equilibrium. This is a signal proof of the incessant ferment of his mighty intellect.

Economic equilibrium, according to Pareto, is to be described as the result of a fundamental opposition of *tastes and obstacles*.

16. "Tastes" is another word for "ophelimities." They are the pleasure that a man experiences in consuming or otherwise using certain things. Economic goods are "*certain things* capable of satisfying the tastes of man" (*Manuale*, pp. 237 and 148).

It is well known, since it has been much discussed, and it has been much discussed both because it was the easiest part of the new doctrine of Pareto, and because chronologically it first saw the light—it is well known, I repeat, that he took over Edgeworth's indifference curves, liberated them from all hedonistic measurement, and turned them into

experimental curves. Experimental, be it well understood, not because such minute experiments as Pareto assumes on the indifferences and preferences of individuals can really be made, but because it is not repugnant to our logic to suppose that they can be made.

Pareto then in imagination covers a plane surface with infinite indifference curves, one inside the other. It is sufficient to have these curves and to know that the individual prefers to move from any curve towards one farther in, and he can then fade out of the picture. Such a family of curves gives the photograph of his tastes. Each curve is the projection on the flat surface of a contour of his so-called "hill of pleasure." There are infinite hills of pleasure which share the same family of curves. From two goods it is possible to pass to any number, and thus the reasoning gains in generality, but loses as much in the intelligibility which indifference curves provide; for we have to proceed into spaces of many dimensions.

The fundamental concept is this, and it is important: namely that the economist should not be preoccupied in finding out whether pleasures are measurable or not, that is, whether it is possible to establish one pleasure so that it is a multiple of another: it is sufficient to know the order in which an individual arranges all the possible combinations of consumption goods in accordance with his preferences. In this unending series there will be numbers of series of indifferent combinations which give rise to absolutely equal pleasure.

Every combination of consumers' goods has an index, hence we can even affirm that it will be sufficient to have merely an ordering of indices. But while all the combinations which belong to the same type of indifference should have the same index, the difference between one index and that which precedes and that which follows it is to some extent arbitrary. Pareto maintained that, "between the infinite systems of indices that we can have, it is most desirable to retain only those which enjoy the property, that if in passing from I to II, a man finds greater pleasure than in passing from II to III, the difference between the indices of I and II is then greater than the difference between the indices of II and III." (*Manuale*, p. 253.)

Pareto worked a good deal on indifference indices, and was able to generalise the idea up to the point of the conception of function indices; i.e. a function capable of indicating by the sign of its derivatives the *direction* in which a certain individual moves. In other words, if the function increases when a certain independent variable x , which represents a certain quantity of a particular good, increases, that signifies that the individual will experience satisfaction in an increase of the quantity of x (he moves in a positive direction with respect to x). If the function decreases the individual finds satisfaction in a diminishing of x . If finally the function neither decreases nor increases, i.e. if the first derivative is zero, that then the individual wishes neither to increase nor decrease x , being in equilibrium with respect to it. (*Manuel*, pp. 659-60, *Economie mathématique*, par. 3.)

Generalising further, Pareto maintained that the function indices can

be used in many connections. For example, it is sufficient to substitute the word "altruism" for "ophelimity," and *ipso facto* a theory of altruism is born. But such generalisations have the alarming quality that the further they are enlarged the more they tend to disappear, so that at a certain point a sense of dismay is produced in the mind of the scientist. Pantaleoni had said in his *Economia Pura* that in a world of perfect altruists the economic phenomena would work out exactly as in a world of perfect egoists, just as an equation is not altered if the signs of all its terms are changed. The truth of such a statement is disputable, but it is perfectly comprehensible. When instead we are asked to believe that it is sufficient to consider as function indices of altruism or asceticism formula 152 of the appendix of the *Manuel*, in order to have a mathematical theory of altruism and asceticism—we remain a trifle perplexed.

17. To know the complete series of the tastes of an individual according to Pareto means—it is by now patent—knowing the whole system of indifferences and preferences of this individual. Experimentally, we may say that an individual *prefers* one combination of goods to another if, confronted with the alternative he *chooses* the first combination, while we may say that he is *indifferent* in respect of two combinations if faced with the alternative of choosing between one or the other, he declares like Buriden's ass that he *can't decide* between the two.

The study of tastes made by Pareto brings out the full significance of the generalisation of those collective functions of demand and supply worked out by Walras.

Pareto always spoke of tastes and of goods as if they were necessarily pleasures or things that would give pleasure, but it is evident from all his treatment that he understood by tastes negative pleasures also, and that goods include services subject to cost. Thus if the treatment is limited to two goods, for example, labour and bread, it is possible to use the analysis so as to be able to draw an indifference curve, indicating, for instance, that an individual will experience the same ophelimity, the same pleasure, the same taste, by working a little more and obtaining a little more bread.

Very interesting are the passages dedicated to the consideration of the *kinds of dependence* between various objects of consumption. The theme of the mutual dependence of lines of consumption already touched upon in the *Cours* is here the subject of all kinds of embellishments. Pareto shows that the pleasure which is experienced in consuming depends also on the *order* of consumption, on the *condition* in which the consumer is, and the connection between, that is, the *complementarity* of, the commodities which can be arranged in a hierarchy according to their different degree of substitutibility. For further discussion on this point we must refer to the *Manuale* (pp. 238-51).

18. In trying to satisfy their own tastes men are not free in their movements but encounter certain obstacles; these obstacles are classified into two categories, "ils sont de deux espèces: les uns sautent aux yeux, les autres sont moins évidents" (*Manuel*, par. 68, p. 175). The obstacles

that spring to the eye are classified as *obstacles of the first order*, the others being *obstacles of the second order*.

Of the former type Pareto offers the following list :

- (a) The tastes of the persons with whom I contract are for me an obstacle.
- (b) If I must divide a given quantity of a commodity with someone else, the limitation of this quantity is an obstacle.
- (c) If I must produce a good, the fact that I cannot achieve my purpose without using other goods is an obstacle.
- (d) The fact that the good desired by me is not disposable when and where I desire it is an obstacle.
- (e) Finally there are obstacles depending on social organisation.

Obstacles of the second order are those that limit the variability of price *during* the exchange, or immediately before the exchange.

It may be said that, for a single individual, apart from his tastes, everything is an obstacle : thus, for instance, if an individual is going to make an exchange, both the tastes of other individuals and the limitation of the goods possessed by himself and the others are obstacles. Thus we can embrace the whole system in a single survey—tastes and obstacles are intertwined in different ways.

19. The study of equilibrium is thus carried to the highest generality. The pure economics of Pareto is purified to such a degree that at a first glance the pure political economy of Walras almost appears to be applied economics. The most interesting innovation, after the elimination of the measurability of satisfaction, consists in the hypothesis of *variable prices*.

The problem of barter, which to Marshall appeared to belong to a category of its own, was in Pareto's view to be regarded as a variety of a definite genus. The general problem is the determination of equilibrium of exchange *under the supposition that prices vary during the exchange*. Here we have a substantial novelty, introduced by Pareto into the theory of economic equilibrium.

20. In the *Manuel* and in the *Economie mathématique*, the following cases are treated :

A. Exchange.

- (1) In conditions of free competition, with fixed and with variable prices.
- (2) In conditions of monopoly, with constant prices :
 - (a) Monopoly of one individual, one good only being monopolised.
 - (b) Monopoly of two individuals, one good only being monopolised.
 - (c) Monopoly of two individuals, two different goods being monopolised.

B. Production.

- (1) In a régime of free competition.
- (2) In a régime of monopoly.
- (3) In a collectivist régime, with constant or variable prices, with coefficients of production fixed or variable.

The economic system, in the words of the author (*Manuel*, p. 658), can be divided into two, mainly, a system of equations which leaves undetermined a certain number of unknowns, and a second system which leaves undetermined a certain number of other unknowns. The first is the system of exchange, the second is that of production. The two systems can be discussed separately, but they are in that case tied down by equations that are only valid in a position of equilibrium. The relation of this construction with that of Walras is perceptible (cp. above 5, VI), but in the Paretian system the argument is much more refined.

21. Having dealt with equilibrium in its broadest sense, Pareto tried to discover whether it was *stable* or *unstable*. Here we have another novelty in the theory of general equilibrium. Pareto justly observes, "Walras considered only stable equilibrium. He was mistaken in believing that starting from a given point participants in exchange must continually approach the equilibrium point. On the contrary, when equilibrium is unstable, they move away from it" (*Economie mathématique*, par. 54 note).

Marshall, as we know, had posed and solved the problem of stable and unstable equilibria, and Pantaleoni had made it generally known in Italy, but it was always treated as an analysis limited to partial equilibrium.

22. Finally, Pareto set himself to discover in what cases a maximum collective ophelimity would result, and found that the maximum of ophelimity is achieved in exchange under free competition, not in monopolistic exchange. It is not reached in the case of monopolistic production, and it cannot even be said that it is always achieved in the case of production in a régime of free competition, since that, according to the notation of Walras, is characterised by the condition "price=cost," but Pareto through the mathematical analysis discovered that a further condition is necessary, namely, that cost achieves a minimum. (We must mention *en passant* that while Pareto considered this second condition a triumph of mathematical economics, it had in fact already been recognised by so-called literary economists.) Further, so far as concerns the question of maximum collective ophelimity, Pareto showed that a society collectively organised is similar to a society governed by perfect competition.

23. Some writers consider it to be a great advantage to be able to decide by means of the mathematical formulæ of Pareto whether the maximum social ophelimity can be achieved. We must make it very clear in order to avoid equivocity that the violent transfer without adaptation of these theorems from the pages of treatises on economic theory to the controversies of actual life is dangerous, not only because the terms of the problems treated mathematically by Pareto are subject to a mass of simplifying hypotheses,

which sever them from reality (par. 14), but also because Pareto, in his character as opponent of literary economics, consciously neglected definitions.

Goods are, "certain things which satisfy tastes." Through tastes we are led back to ophelimity. Ophelimity is a thing which exists only in so far as a certain differential expression admits a factor of integrability. The expression *things* is applied both to material objects and uses. "Il est bien entendu que par le terme de choses on entend non seulement des choses matérielles, mais encore l'usage de certaines choses" (*Economie mathématique*, par. 213). And these things whose *use* is also a thing are identified with the services of "capitaux," since Pareto had already postulated that capital is a term useless in itself. At the same time, since to discuss economic problems while ostracising the word capital is not always possible, we are informed that "'capitaux' are certain things whose services come to be transformed into certain other things." In case this indeterminateness of definition is insufficient, he calls goods both things which give pleasure and those which, at the end of the tale, give displeasure, and thus satisfactions and subjective costs are blended together within three or four letters of the alphabet. Again this maximum collective ophelimity is defined in a manner by no means clear and unequivocal (*Manuel*, pp. 314 and 617) (on p. 618 a new condition is postulated).

The whole thing is rather vague. The book is full of propositions mentioned by way of example and analogy. We grow accustomed to x and y and "etc." Literary economists no doubt lose time defining concepts and comparing definitions, but nevertheless we then know what they are talking about.

VI. COMPARISON BETWEEN THE THEORY OF GENERAL EQUILIBRIUM (WALRAS-PARETO) AND THE THEORY OF PARTIAL EQUILIBRIUM (MARSHALL).

24. What finally is our judgment on the theory of *general* economic equilibrium linked with the names of Walras and Pareto?

We may at once accede to the following propositions:

That it is a powerful synthesis of economic phenomena which must arouse the admiration of those who after long study succeed in understanding it.

That it is a logical construction infinitely more comprehensive and coherent than the old theories of value and distribution for which it is a substitute.

That for all investigators of economic phenomena it keeps in view by way of caveat the fact that the demand and the supply of everything bought and sold, and all the relations between quantities that are exchanged and quantities into which things are mutually transformed, are interdependent. With this warning in view we are given a stimulus to follow up the economic effects of any variation of equilibrium into places where we should not expect to find them.

That it gives a method of correctly formulating problems by setting

out systematically what are the logical connections binding economic variables together, and of making sure at every stage that the number of independent logical relationships is equal to the number of these variables (unknowns).

25. But when we have granted all this and paid the tribute due to the authors of one of the most outstanding creations of human thought, we are compelled to limit the field of its application.

The whole apparatus gives somewhat the impression of a magic castle, satisfying to the imagination but of little assistance in solving the housing problem. In more prosaic language the theory remains abstract and without grip. We might make use here of a metaphor which economists are fond of in connection with the comparison of satisfactions of different individuals, and say that among the theories of equilibrium enshrined in the formidable apparatus of the formulæ of the *Manuel d'économie politique*, and of the article in the *French Mathematical Encyclopedia*, there is to be found no bridge leading to nine-tenths of the problems which economists set themselves. Shall we be able to build the bridge when mathematical analysis has progressed and statistical data become more numerous? Such must be our wish. Could separate parts of the theory of equilibrium, for instance the theory of individual budget balancing, be developed and exploited for practical use in a relatively short time? We may hope so.

26. In the meantime we can by no means afford to put aside the theory of particular equilibrium as developed by Marshall and his many followers.

Pareto always tried to be different from Marshall, as he explicitly declared on many occasions. For example, on page 557 of the *Manuel*, he wrote, " Nous nous séparons complètement non seulement des économistes dits de l'Ecole Autrichienne, mais aussi d'autres économistes tels que le Prof. Marshall, en ce que, à notre avis, seule la nécessité de considérer les systèmes d'équations simultanées qui déterminent l'équilibre dans le cas général, justifie l'usage des mathématiques en économie politique. Nous estimons que l'usage des mathématiques pour des problèmes du genre de celui d'un individu et de deux, ou même de plusieurs biens, ne donne pas des résultats dont l'importance puisse se comparer à ceux que l'on obtient dans les cas de l'équilibre économique général. A notre avis c'est l'interdépendance des phénomènes économiques qui nous oblige à faire usage de la logique mathématique. Cette manière de voir peut être bonne ou mauvaise; mais en tous cas elle ne doit pas être confondue avec celles des économistes qui établissent les théories en négligeant précisément cette interdépendance."

Everyone who does not apply the theory of general equilibrium is dubbed a literary economist. Hence whoever cultivates the theory of particular equilibrium is a literary economist. This seems to be Pareto's idea. "C'est un système d'équations qu'il faut résoudre, ce n'est pas une suite d'équations isolées, indépendantes, c'est parce que les économistes littéraires n'ont pas d'idées claires, non seulement sur la résolution d'un système d'équations simultanées, ni même sur la nature d'un tel problème, qu'ils font des efforts désespérés pour substituer à ce système d'équations simultanées, un système d'équations pouvant être résolues chacune isolé-

ment, ce problème étant le seul que l'état de leurs connaissances leur permette d'aborder. C'est ce qui les a induits en erreur au sujet de la théorie générale de l'équilibre économique, et ce qui continue de les induire en erreur en ce cas particulier'' (*Manuel*, pp. 637-8).

Nevertheless, in our judgment the present position of economic science is one of Hamlet-like hesitation, and this is one of the substantial causes of the extreme difficulty or perhaps impossibility at the present time of systematising the mass of material available in a rigorously scientific treatise. We feel that the theory of general economic equilibrium is *more true* than the theory of particular equilibrium, but we must confine ourselves to receiving general guidance from it. We cannot abandon other theories, less complete but more manageable. We must, in fact, retain both. We can glimpse the boundless horizons of the theory of equilibrium, and we can even describe it a little. We must, nevertheless, hold ourselves within the confines of a more secure zone, and limit to it our more profound investigations.

27. This explains why Marshall's theory will always be popular, and why Barone, who attempted to make a Paretian manual, always found himself driven to neglect the mutual dependence of all economic phenomena, and to cover his pages with plane curves, implicitly presupposing that the variations of one economic quantity depend only on the variations of another economic quantity.

Pareto himself, the most jealous custodian of the theory of economic equilibrium, the most sarcastic belittler of literary economics, the less sarcastic but not less resolute adversary of the theory of particular equilibria, was compelled to forget general equilibrium when he was writing his superb chapters on applied economics.

It is a final confirmation of the extent of his genius when we find him combining his highly abstract investigations into equilibrium theory with statistical researches into distribution. The expert analyst of interests and sentiments had a vast range outside the field of pure economics; as is shown by his *Systèmes Socialistes*, his *Cours*, his *Sociologia*, and in an immense variety of articles in journals and reviews, especially those written in the last years of his fertile career.

[Translated by URSULA K. WEBB, London.]