

Critical Essays on Piero Sraffa's Legacy in Economics

Edited by

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Piero Sraffa's contributions to economics: a brief survey

Heinz D. Kurz and Neri Salvadori

In this note a brief summary of Sraffa's contributions to economics will be given. This summary serves two purposes. It introduces the following discussion and it informs the reader about some contributions to economics by Sraffa not dealt with at all, or dealt with only in passing, in the essays contained in this book. In addition, some of the important developments triggered by his contributions will be mentioned. The overall purpose of this note is to round up the picture of Piero Sraffa's legacy in economics. It is not claimed that the account given is complete with regard to Sraffa's own works or the body of literature inspired by them. Summaries imply selection and interpretation, and consequently reflect the predilection and views of the authors. Other people may see things differently from the way we see them.¹ However, we have made an effort to present things as impartially as is possible to us.

1 Early works

Piero Sraffa was born in Turin, Italy, on 5 August 1898.² After graduation from the local university he went to the London School of Economics (1921–22). In England he was introduced to John Maynard Keynes who invited him to contribute an article on the Italian banking system for the *Manchester Guardian*, and a paper entitled 'The Bank Crisis in Italy' for the *Economic Journal* (Sraffa, 1922). This article, which contained an attack on the Fascists, provoked fierce reactions

¹ In what follows we draw partly on a book and papers written together (see, in particular, Kurz and Salvadori, 1995, 1997).

² On Sraffa's life and work, see Roncaglia (1978), Potier (1991) and Schefold (1996).

from the Mussolini government. Nevertheless, in November 1923 Sraffa was appointed to a lectureship in Political Economy and Public Finance at the University of Perugia. The preparation of his lectures stimulated him to write his first influential work in economics, 'Sulle relazioni fra costo e quantità prodotta' (1925), which contains an analysis of the foundations of decreasing, constant and increasing returns in Alfred Marshall's theory and a critical discussion of the entire partial equilibrium approach. Not least due to this article, Sraffa was appointed to a full professorship in Political Economy at the University of Cagliari, a post he held *in absentia* to the end of his life, donating his salary to the library. Francis Y. Edgeworth's high opinion of the article led to an invitation to publish a version of it in the *Economic Journal* (cf. Sraffa, 1926). This paper starts with the observation:

A striking feature of the present position of economic science is the almost unanimous agreement at which economists have arrived regarding the theory of competitive value, which is inspired by the fundamental symmetry existing between the forces of demand and those of supply, and is based upon the assumption that the essential causes determining the price of particular commodities may be simplified and grouped together so as to be represented by a pair of intersecting curves of collective demand and supply. This state of things is in such marked contrast with the controversies on the theory of value by which political economy was characterised during the past century that it might almost be thought that from these clashes of thought the spark of an ultimate truth had at length been struck. (Sraffa, 1926, p. 535)

Sraffa did not agree with this view, which was the 'mainstream' of the time, at least in England and in the English-speaking countries. He objected that in 'the tranquil view which the modern theory of value presents us there is one dark spot which disturbs the harmony of the whole'. This 'dark spot', he added, is the supply curve, based upon the combination of the laws of increasing and diminishing returns. Its foundations, he maintained, 'are actually so weak as to be unable to support the weight imposed upon them' (*ibid.*, p. 536).

Consider the usual textbook partial equilibrium argument. A change in one market (e.g. a shift in the demand curve for wine) is taken to have first an effect on the equilibrium of that market (e.g. a change in the price and the quantity of wine produced), and then perhaps an effect on the other markets as a consequence of the change in price and quantity determined in the market where the original change took place (e.g. a shift in the demand for grapes, used to produce wine, and in the demand for beer, a wine substitute). If it can be assumed that the effects on the other markets are of a second order of magnitude with respect to the

effect obtained on the equilibrium of the market in which the original change took place, and if these former effects are assumed to be so small that they can be neglected, at least at a first stage, then the supply and demand curves of a given market can be considered, in regard to small variations, as independent both of each other and of the supply and demand curves of all other commodities.

Sraffa's criticism focuses on variable returns, distinguishing between the following cases: variable returns that are (i) internal to the firm; (ii) external to the firm but internal to the industry; (iii) external to both the firm and the industry. Variable returns of type (i) are obviously incompatible with the assumption of perfect competition, whereas variable returns of type (iii) are incompatible with the method of partial equilibrium. Only variable returns of type (ii), whose empirical importance is doubtful, are shown to be compatible with Marshall's analysis of the supply curve of an industry in conditions of perfect competition.

Sraffa (1925, 1926) showed that variable returns of type (iii) are incompatible with the method of partial equilibrium in terms of the following argument: it cannot be excluded that a change in the quantity produced by a variable cost industry *at the same time* entails a change in the costs of firms in *other* industries as it entails a change in the costs of firms in the industry in which the change in the quantity produced took place. A typical example is that in which the same quality of land is used to produce two different commodities, say grapes and hops. An increase in the production of grapes, for instance, may lead to a rise in the cost function of the producers of grapes because of an increase in the rent paid for the use of the land, but this rise in rent would likewise affect the cost function of the producers of hops. The changes in costs would be of the same order of magnitude in both industries, so that it would be illegitimate to disregard the changes in the cost functions of firms outside the industry in which the quantity produced has changed (i.e. hops), while only taking into account the changes obtained in the cost functions of firms inside the industry in which the variation in quantity took place (i.e. grapes). The necessity to take other industries into account is accentuated in the case in which these industries provide means of production to the industry in which the implications of a change in quantity is studied.

When a change in the quantity produced by a variable cost industry does not entail a change in the costs of firms in other industries, the variable costs are said to be *internal to the industry*. A typical example is that in which returns are decreasing because land is in short supply and each quality of land is specific to the production of a single commodity only. If the economies or diseconomies responsible for variable costs are external to the firm and internal to the industry, variations in the quantity

produced by one industry may affect the cost functions of the firms outside that industry only as a consequence of the change in the equilibrium price and quantity of the commodity produced by the industry in which the variation took place. This would be an effect of the second order of magnitude only, the presence of which, it could be contended, is perhaps compatible with using the *ceteris paribus* clause (see also Roncaglia, 1978; Panico, 1991; Samuelson, 1991; Kurz and Salvadori, 1995, chaps 1 and 13).

From this, Sraffa (1925) concluded that with regard to small variations in the quantity produced, the assumption of constant returns is the most convenient one for the analysis of the supply curve of an industry under competitive conditions. This view is repeated towards the end of the first part of the 1926 paper and interpreted as giving support to the classical doctrine: 'the old and now obsolete theory which makes it [the competitive value] dependent on the cost of production alone appears to hold its ground as the best available' (1926, p. 541). Yet this proposition could not leave Sraffa satisfied. He was confronted with two alternatives: either to abandon the assumption of perfect competition or to abandon partial equilibrium analysis. As is well known, Sraffa initially hinted at the first route, but soon embarked on the second.

In his 1926 paper the second alternative was ruled out on the grounds that an examination of 'the conditions of simultaneous equilibrium in numerous industries' is far too complex: 'the present state of our knowledge... does not permit of even much simpler schema being applied to the study of real conditions' (*ibid.*, p. 541). There remained the first alternative, which was also motivated in terms of two related arguments. First, '[e]veryday experience... that a very large number of undertakings – and the majority of those which produce manufactured consumers' goods – work under conditions of individual diminishing costs' suggests the abandonment of the hypothesis of perfect competition (*ibid.*, p. 543). Secondly, it is argued that the

chief obstacle against which [business men] have to contend when they want gradually to increase their production does not lie in the cost of production... but in the difficulty of selling the larger quantity of goods without reducing the price, or without having to face increased marketing expenses. This... is only an aspect of the usual descending demand curve, with the difference that instead of concerning the whole of a commodity, whatever its origin, it relates only to the goods produced by a particular firm. (*ibid.*)

In his 1926 paper, Sraffa therefore suggested retaining partial equilibrium analysis. This was possible, however, only at the cost of abandoning the concern with the free competition form of markets: in order to

preserve the partial framework the analysis had to be limited to the study of economies internal to the firm. Sraffa's proposal was taken up by several authors and triggered a rich literature on market forms which bloomed during the 1930s (see, especially, Joan Robinson, 1933). Apart from a contribution to the 1930 *Economic Journal* symposium on increasing returns, Sraffa did not participate further in the debate on the Marshallian theory of value. Keynes, in the 'Note by the Editor' introducing the debate, called Sraffa's intervention a 'negative and destructive criticism'. This assessment is confirmed by Sraffa's concluding remark in his rejoinder to Robertson:

I am trying to find what are the assumptions implicit in Marshall's theory; if Mr Robertson regards them as extremely unreal, I sympathise with him. We seem to be agreed that the theory cannot be interpreted in a way which makes it logically self-consistent and, at the same time, reconciles it with the facts it sets out to explain. Mr Robertson's remedy is to discard mathematics, and he suggests that my remedy is to discard the facts; perhaps I ought to have explained that, in the circumstances, I think it is Marshall's theory that should be discarded. (Sraffa, 1930, p. 93)

We know that Sraffa's analytical concern following the 1926 paper was 'the process of diffusion of profits throughout the various stages of production and of the process of forming a normal level of profits throughout all the industries of a country...[a problem] beyond the scope of this article' (1926, p. 550; see also Eatwell and Panico, 1987).

2 The collaboration with Keynes and the controversy with Hayek

In the mid-1920s Sraffa was offered a lectureship in Cambridge which he assumed in October 1927, starting to lecture on advanced theory of value in the Michaelmas Term 1928–29. He was to lecture for only three years. A main reason for giving up teaching was that by that time Sraffa was convinced that Marshallian analysis could not be remedied and that an alternative analysis had to be elaborated, the beginnings of which took shape in the systems of equations of production Sraffa formulated in the late 1920s (see Kurz, 1998). In 1930 Sraffa was appointed to the position of librarian of the Marshall Library and was also placed in charge of the Cambridge programme of graduate studies in economics.

Shortly after his arrival in Cambridge, Sraffa showed Keynes the set of propositions which were to grow into *Production of Commodities by Means of Commodities*. However, his work on the manuscript was delayed both by the intense debate in Cambridge surrounding Keynes'

Treatise on Money and, later, *The General Theory*, and by Sraffa assuming, in 1930, the editorship of the Royal Economic Society edition of *The Works and Correspondence of David Ricardo*. Sraffa participated in the famous Cambridge ‘Circus’ and was known for his breadth of knowledge and impeccable logic. This is neatly illustrated by a short note written by Joan Robinson to Keynes in 1932:

I think that like the rest of us you have had your faith in supply curves shaken by Piero. But what he attacks are just the one-by-one supply curves that you regard as legitimate. His objections do not apply to the supply curve of output [as a whole] – but Heaven help us when he starts thinking out objections that do apply to it! (Keynes, *CW*, Vol. XIII, p. 378)

There is evidence that the fastidious Sraffa did not think highly of the way Keynes wrote his books, and especially the *General Theory*. He gradually withdrew from the Circus. His collaboration with Keynes became largely restricted to the field of the history of ideas. Thus in 1935 the two edited David Hume’s *Abstract of a Treatise on Human Nature* (Hume, 1938). In their introduction they argued convincingly that the previous attribution of this essay to Adam Smith could not be sustained.

In 1931, Friedrich August von Hayek published *Prices and Production*, a book based on four lectures given at the London School of Economics (Hayek, 1931a), and the first part of his critical review in two instalments of Keynes’ *Treatise on Money in Economica*, entitled ‘Reflections on the Pure Theory of Money of Mr. J. M. Keynes’ (1931b). In both contributions Hayek rejected the explanation of economic crises in terms of a deficient aggregate demand. In his book he elaborated the ‘Austrian’ approach to the theory of money and economic fluctuations, tracing crises back to ‘misdirections of production’ caused by the banking system fixing the money rate of interest below the ‘equilibrium rate’. Keynes tried to answer the challenge, but like other Anglo-Saxon and American economists apparently had difficulties in understanding and countering Hayek’s view because of a lack of knowledge of the main building blocks of his analysis: Paretian general equilibrium theory and Böhm–Bawerkian theory of capital and interest. Keynes invited Sraffa, who was familiar with both intellectual traditions, to accomplish what he himself had difficulties in doing, that is, ward off Hayek’s attack.

In 1932 Sraffa published ‘Dr. Hayek on Money and Capital’ in the *Economic Journal* (Sraffa, 1932a). Hayek replied in the same year (Hayek, 1932), followed by a short rejoinder by Sraffa (1932b). Sraffa’s criticism in his review article was purely internal: he scrutinized the consistency of Hayek’s argument in the context of the latter’s own analytical frame-

work, and showed that Hayek had committed a number of serious blunders which deprived his analysis of all explanatory value. By assuming that money had only a single function – that of a means of exchange – and thus ignoring its role as a store of value, Hayek had been dealing with an economic system with ‘emasculated’ money. How could such an economy behave differently from an economy without money, that is, a barter economy? Apparently, Sraffa argued, Hayek must have introduced an element that is extraneous to the discussion which causes the difference. This element is said to become visible in Hayek’s treatment of what he called the case of ‘voluntary saving’ on the one hand and that of ‘forced saving’ on the other. The first of the polar cases concerns a change in one item of the ‘fundamental’ data of economic equilibrium: intertemporal preferences. In Hayek’s marginalist setting, an increase in ‘voluntary saving’ means the decision of agents to forgo present for future consumption. In an economic system with a given and constant labour supply and a given and constant technical knowledge, this involves that more ‘roundabout’, or ‘capitalistic’, processes of production will be adopted, characterized by a higher consumption output per capita. This, in turn, involves a change in the proportion of gross income spent on consumption and the proportion spent on capital goods, that is, a change in gross savings. Net savings will be positive only during the transitory phase until a new and stable equilibrium is reached.

While in Hayek’s view this case is unproblematic, the other concerns interventions into the ‘voluntary decisions of individuals’ and thus infringes upon their freedom of action. A money rate of interest fixed below the ‘equilibrium’ rate by the banking system leads to an expansion of producers’ or of consumers’ credit. In the former case producers will find it profitable to lengthen the ‘average period of production’. This is only possible, however, if labour and nonspecific factors of production are shifted from lower stages of production, that is, those that are close to the ‘maturing’ of the consumption goods, to higher stages, thereby imposing on agents a reduction in consumption, that is, ‘forced saving’. Eventually incomes will rise and since the preferences of agents have not changed, consumption demand will go up. Prices of consumer goods will rise, indicating to producers that it is profitable to adopt less ‘roundabout’ processes of production. As a consequence, capital has to be reduced again – a process that ‘necessarily takes the form of an economic crisis’ (Hayek, 1931a, p. 53). After a costly trip and on the assumption that the banking system eventually corrects its error, the system is bound to return to its original equilibrium.

Interestingly, while in Hayek’s opinion the ‘artificial stimulant’ of inflation in the shape of producers’ credits can do no good, such a

stimulant in the shape of consumers' credits is said to do harm, because it tends 'to frustrate the effect of saving' (ibid., p. 57). Accordingly, inflation through consumers' credits would effectively decrease capital and push the system to a new equilibrium with a lower consumption output per capita. Sraffa's dry comment reads: 'Thus Dr. Hayek will have it both ways' (Sraffa, 1932a, p. 48). Hayek's claim that the two cases are not analogous finally reveals the 'error or irrelevancy' which is responsible for the fact that, contrary to what one would have expected, a rise or fall in the quantity of 'emasculated' money can make a difference.

Sraffa also took issue with Hayek's claim that a difference between the actual or money rate of interest and the 'natural' or 'equilibrium' rate is a characteristic of a money economy (ibid., p. 49). He illustrated his argument in terms of an example which introduced the concept of the *own-rate of interest*, or, as he preferred to call it, the 'commodity rate of interest'. Both in the monetary and the barter economy, loans are made in terms of all commodities for which there are forward markets. Out of equilibrium these own rates will be different for at least some commodities. Hayek's opinion that in a 'disequilibrium' caused by a sudden increase in money supply (in the propensity to save) the natural rate of interest would be above (below) the money rate does not make sense, because out of equilibrium there is no such thing as *the* 'natural' rate; there will rather be a multiplicity of 'natural' rates.

Apparently, Keynes was very pleased with Sraffa's performance: it had effectively countered the assault on his intellectual project launched by Lionel Robbins and his circle at the LSE and allowed him to develop the *General Theory* undisturbed from any further interventions by the Austrian economist. In Chapter 17 of the *General Theory*, 'The Essential Properties of Interest and Money', Keynes wanted to pay tribute to Sraffa by making use of the concept of own rates of interest, arguing that the money own rate of interest is determined by liquidity preference, which, in a given time and place, is a conventional datum (cf. Keynes, *CW*, Vol. VII, pp. 222–44). As we know from his yet unpublished papers, Sraffa was not at all happy with what Keynes had done and was rather critical of his liquidity preference theory. His main objection was 'that the advantages involved in *holding* a commodity have no relation to its "own particular rate of interest"; and indeed no properties of that commodity (apart from expected price change) have any relations to the difference between its rate and other rates.' Keynes was wrong in assuming that the own rates of interest on different articles corresponded to the different advantages or disadvantages (yield, carrying cost, liquidity) associated with their possession. If no changes in price are expected, *all* commodities will have the same rate of interest.

3 The edition of Ricardo's *Works and Correspondence*

By the late 1940s, the publication of the Ricardo edition had been long delayed (see Pollit, 1990). The first volumes of the *Works and Correspondence of David Ricardo* were finally published in 1951 (Ricardo, 1951–73). This edition, for which Sraffa was awarded the golden medal Søderstrøm in 1961 by the Swedish Royal Academy, is widely acknowledged to be a scholarly masterpiece. In his 'Introduction' to Volume I, Sraffa presented an interpretation of the classical approach to the theory of value and distribution which differed markedly from the then dominant interpretation that had been put forward by Alfred Marshall. As we know from the manuscript of Sraffa's lectures on advanced value theory in the late 1920s and early 1930s and from his 1926 characterization of the classical theory of value, Sraffa had originally read Ricardo through the lens of Marshall's interpretation. (Indeed, for quite some time Marshall *was* economics for Sraffa.) A careful reading of Ricardo's writings eventually convinced him that this interpretation did not stand up to close examination.

The new interpretation centres around the concept of social *surplus*. Since in Ricardo's view the problem of income distribution 'is the principal problem in Political Economy' (*Works*, I, p. 6), Ricardo's main concern was with elaborating a coherent theory of the rate of profits, based on that concept: 'Profits come out of the surplus produce' (*Works*, II, pp. 130–31; similarly *Works*, I, p. 95). According to Sraffa, the development of Ricardo's thoughts on the matter can be divided into four steps (cf. Sraffa, 1951, pp. xxxi–xxxiii). These steps reflect Ricardo's consecutive attempts to simplify the problem of distribution.

The first step consisted of eliminating the problem of the rent of land in terms of the theory of extensive rent developed in Ricardo's *Essay on the Influence of a low Price of Corn on the Profits of Stock*, published in 1815 (see *Works*, IV). This allowed him to focus attention on marginal, that is, no-rent, land: 'By getting rid of rent, which we may do on the corn produced with the capital last employed, and on all commodities produced by labour in manufactures, the distribution between capitalist and labourer becomes a much more simple consideration' (*Works*, VIII, p. 194). The theory of extensive rent also provided the basis for a first criticism of what Ricardo called Smith's 'original error respecting value' (*Works*, VII, p. 100), that is, the latter's doctrine that 'the natural price itself varies with the natural rate of each of its component parts, of wages, profit, and rent' (Smith, *WN*, I.vii.33). As Ricardo stressed in the *Principles*, the price of 'corn is not high because a rent is paid, but a rent is paid because corn is high' (*Works*, I, p. 74).

If the high price of corn were the effect, and not the cause of rent, price would be proportionally influenced as rents were high or low, and rent would be a component part of price. But that corn which is produced [on marginal land] is the regulator of the price of corn; and rent does not and cannot enter in the least degree as a component part of its price. Adam Smith, therefore, cannot be correct. (*Works*, I, p. 77)

In Sraffa's interpretation, the second step consisted of trying to get rid of the problem of value by assuming the 'corn model': with wages as the only capital advanced at the beginning of the period of production and wages paid in terms of corn, the rate of profit obtained in corn production can be ascertained directly as a ratio of quantities of corn – that of the surplus product to the corn capital advanced – without any need to have recourse to prices. With corn entering the production of all other commodities (as the only wage good and possibly also as an input) the prices of these commodities would have to adjust such that the same competitive rate of return could be earned in their production. Sraffa stressed: 'Although this argument is never stated by Ricardo in any of his extant letters and papers, he must have formulated it either in his lost "papers on the profits of Capital" of March 1814 or in conversation [with Malthus]' (Sraffa, 1951, p. xxxi).³

Yet Ricardo did not, of course, dispute the correctness of Malthus's observation that there is no industry in which the composition of the product is exactly the same as that of the capital advanced. It is here that the theories of distribution based on the concept of social surplus are confronted with the problem of value. For in physical terms the general rate of profits is the ratio between the social surplus and the social capital. Since the two aggregates of heterogeneous commodities generally differ in composition, they cannot be compared unless they are made commensurable, that is, expressed as *value* magnitudes. Therefore, in a third step, in the *Principles* Ricardo presented a theory of value according to which the exchange values of commodities are regulated by the quantities of labour needed, directly and indirectly, in their production. The surplus product and the social capital, that is, the two magnitudes whose ratio gives the general rate of profits, could thus be 'measured' in terms of embodied labour. Hence, what was to become known as the 'labour theory of value' was introduced by Ricardo precisely in order to overcome the analytical difficulty encountered in his attempt to explain prof-

³ Sraffa's 'corn model' interpretation gave rise to a large and still mounting literature; see the references in Kurz and Salvadori (1995, pp. 87–9); see also Hollander (1995) and De Vivo (1996).

its in terms of the surplus product left after making allowance for the cost of production, including the wages of productive workers.

However, Ricardo soon realized that the principle that the quantity of labour bestowed on the production of commodities regulates their exchangeable value cannot be sustained as a 'general rule' of value: it is 'considerably modified by the employment of machinery and other fixed and durable capital' (*Works*, I, p. 30). With different proportions of (direct) labour to means of production in different industries, and with different durabilities of these means of production, relative prices would not only depend on the quantities of total labour 'embodied' in the various commodities, but also on the level of the rate of profits, and would change with that level. This is so because with (compound) interest the weight of the profit component in prices depends on the rate of profits. Ricardo's search for a measure of value that is 'invariable' with respect to changes in distribution, that is, variations in the real wage rate and the associated contrary variations in the rate of profits, is considered by Sraffa as the final step in Ricardo's efforts to simplify the theory of distribution. The measure of value he was in search of was meant to corroborate his conviction that the laws of distribution 'are not essentially connected with the doctrine of value' (*Works*, VIII, p. 194).⁴

Sraffa deserves the credit for having rediscovered the 'classical' approach to the theory of value and distribution. After its excavation, that approach had to be elaborated and, if possible, given a logically coherent formulation, taking into consideration all the economic phenomena such as fixed capital, joint production and natural resources with which the earlier authors had grappled with only limited success.

4 Production of commodities by means of commodities

From the mid-1950s, Sraffa eventually found time to put together, revise and complete his notes on the classical approach to the theory of value and distribution. The resulting book was published in 1960 and entitled *Production of Commodities by Means of Commodities. Prelude to a Critique of Economic Theory* (Sraffa, 1960). As regards the critique implicit in the book, the main target was marginal theory:

It is ... a peculiar feature of the set of propositions now published that, although they do not enter into any discussion of the marginal theory of value and distribution, they have nevertheless been designed to serve as the basis for a critique of that theory. If the foundation holds, the critique may be attempted later, either

⁴ For a detailed discussion of Ricardo's search for an 'invariable' measure of value, and its relationship to Sraffa's 'Standard Commodity', see Kurz and Salvadori (1993).

by the writer or by someone younger and better equipped for the task. (Ibid., p. vi)

Since the publication of the book the critique has been carried out in the so-called Cambridge controversies in the theory of capital (see Harcourt, 1972; Garegnani, 1990; Kurz and Salvadori, 1995, Chap.14). Major representatives of the neoclassical school openly admitted that the criticism levelled at long-period neoclassical theory is indeed correct.⁵ The question remained whether the critique (or elements of it) carries over to short-period neoclassical analysis, that is, the theories of inter-temporal and temporary equilibrium.

According to some interpreters, Sraffa's book was exclusively designed for the negative task of serving as the basis for a critique of neoclassical theory. However, this interpretation cannot be sustained. Sraffa's work was first and foremost constructive. (Sraffa's concern with the constructive task becomes obvious when reading his unpublished papers in the Wren Library at Trinity College, Cambridge.) He may be said to have followed Spinoza's famous dictum *determinatio est negatio*: by elaborating a coherent theory of income distribution and relative prices he sought to prepare the ground for the critical task.

As Sraffa made clear in the preface, the standpoint taken in his book 'is that of the old classical economists from Adam Smith to Ricardo, [which] has been submerged and forgotten since the advent of the "marginal" method' (Sraffa, 1960, p. v). The affiliation of his analysis with the theories of the old classical economists is stressed again in the following remark concerning the concept of 'price' or 'value' adopted in the book: 'Such classical terms as "necessary price", "natural price" or "price of production" would meet the case, but value and price have been preferred as being shorter and in the present context (which contains no reference to market prices) no more ambiguous' (ibid., p. 9). Finally, Appendix D to the book provides additional 'References to the Literature' concerning special ideas and concepts of classical derivation, 'the source of which may not be obvious' (ibid., p. 93). Hence his book was explicitly designed to reconstruct the classical theory of value and distribution. (For additional evidence see Kurz, 1998.)

⁵ For example, Frank H. Hahn frankly admitted that the Sraffa-based critique is correct with respect to 'many writers whom we regard as neoclassical who have either made mistakes of reasoning or based themselves on special assumptions which have themselves nothing to do with neoclassical theory' (Hahn, 1982, p. 354). In another place, Hahn admitted that he himself 'every so often slipped into the aggregate version of the neoclassical model' (Hahn, 1972, p. 8). He also expressed the opinion that 'Sraffa's book contains no formal propositions which I consider to be wrong although here and there it contains remarks which I consider to be false' (1982, p. 353).

Scrutiny shows that Sraffa follows the classical authors not only in terms of the method adopted and the general approach chosen, but broadly also in terms of the two-part structure of their argument. In one part he is concerned with investigating *given* 'systems of production'. The relationship between relative prices, the general rate of profits and the wage rate implicit in the given system of production, or 'technique', is analysed partly in formal terms: it is systems of equations that prove to be appropriate in this context. Subsequently, Sraffa turns to the problem of which system of production will be adopted from a set of alternative systems, that is, the choice of technique problem. Hence, what was initially taken as given is now an *unknown*. This is dealt with in Chapter XII, 'Switch in Methods of Production'. Sraffa assumes that the choice between alternative techniques 'will be exclusively grounded on cheapness' (*ibid.*, p. 83). In other words, he is concerned with determining the *cost-minimizing* system(s) of production. In comparing different methods of production to produce the same commodity, the phenomena of *extra costs* and *extra profits* make an appearance. Although Sraffa does not provide a formalization of his argument, it is clear that in this context inequalities rather than equations would be appropriate.

Sraffa proceeds in the following way. In Chapter I he deals with an economic system actually in operation, assuming that it is capable of *self-replacement*, that is, of each commodity it produces as much (i) as is needed in order to make good the quantity used up of the commodity under consideration as a means of production across all industries of the economy, (ii) plus the quantity of it needed to provide food, shelter etc. at a given (minimum) level for those engaged in production. He then assumes that any remaining surplus product, that is, quantities of the different commodities produced in excess of the requirements of self-replacement, are made to disappear. This leaves him with a system which he calls 'Production without Surplus'. He finds out that in such a system the relative exchange values of commodities, or price ratios, 'spring directly from the methods of production and productive consumption' (*ibid.*, p. 3). In Chapter II he brings the surplus back into the picture, assuming that this surplus will be distributed in the form of profits on capital at a uniform rate, that is, in proportion to the capital advanced in each industry. Since the means of production and means of subsistence advanced in each industry at the beginning of the (uniform) production period consist of sets of heterogeneous commodities, the magnitude of each industry's capital can only be ascertained once prices are known. However, prices cannot be determined independently of the rate of profits. Hence, Sraffa concludes, prices and the rate of profits must be determined *simultaneously*. The concept of surplus then leads to the

distinction between *basic* and *non-basic products*, and to the assumption that there exists at least one basic commodity. Basic products enter directly or indirectly into the production of all commodities, whereas non-basic products do not. The main aim of Chapter III is to provide a first discussion of price movements consequent upon hypothetical changes in distribution on the assumption that the methods of production remain unchanged. Sraffa concludes 'this preliminary survey of the subject' (*ibid.*, p. 15) by asserting that

the relative price-movements of two products come to depend, not only on the 'proportions' of labour to means of production by which they are respectively produced, but also on the 'proportions' by which those means have themselves been produced, and also on the 'proportions' by which the means of production of those means of production have been produced, and so on. The result is that the relative price of two products may move . . . in the opposite direction to what we might have expected on the basis of their respective 'proportions'; besides, the prices of their respective means of production may move in such a way as to reverse the order of the two products as to higher and lower proportions; *and further complications arise, which will be considered subsequently.* (*Ibid.*, p. 15; emphasis added)

The complete analysis of price movements in the case of single production is provided in Chapter VI. This chapter also contains the well-known example of the 'old wine' and the 'oak chest', showing that the difference between the prices of two commodities can be positive or negative depending on income distribution. The analysis is significantly simplified by the use of the 'Standard Commodity' as numéraire. Chapters IV and V of Sraffa's book are in fact devoted to the introduction of this tool of analysis and to the study of its properties.

Part II of Sraffa's book generalizes the study in Part I, which was restricted to circulating capital only, to the case of multiple-product industries. It contains impressive counter-evidence to William Stanley Jevons's contention that the classical approach is in principle incapable of dealing with this more realistic and complex case and, as a result of this and other weaknesses, had to be abandoned and a new theoretical approach explored (see Kurz, 1986). Sraffa deserves the credit for having demonstrated that the multiple-product industries framework is suited to the analysis of a wide range of problems, including fixed capital and land.

The method of treating what remains of *fixed capital* goods at the end of the production period as part of the gross output, jointly with those products which are the primary object of the productive activity, fits easily into the classical picture and was first introduced by Robert Torrens in the course of a criticism of Ricardo's doctrine (Sraffa, 1960,

p. 94). The method allows the correct calculation of the annual charge on the fixed capital consisting of the payment of profit at the uniform rate and the depreciation that makes possible the replacement of the durable instrument of production when it is worn out. Most importantly, the method is not restricted to the simplified case of constant efficiency, but has general validity (*ibid.*, p. 66). It is shown that the depreciation quotas, and thus the price of ageing machinery, cannot be ascertained independently of distribution, which is contrary to a widespread belief that finds expression in *ad hoc* rules such as linear depreciation, 'radio-active decay' or 'depreciation by evaporation'.

In the case of constant efficiency, the value of an item of fixed capital decreases linearly during its lifetime of n years only if $r = 0$, whereas for $r > 0$ the value follows a stepped curve which will be the more concave toward the origin the higher the rate of profits (*ibid.*, p. 71). This variation in the time profile traced by the price of the ageing fixed capital good when the rate of profits changes is exclusively due to the necessity of maintaining the uniformity in price of all items of the commodity irrespective of the age of the fixed capital goods by means of which they are respectively produced. Obviously, the area below such a curve, defined for a particular level of r , is a measure of the aggregate value of a capital stock consisting of n pieces of the durable instrument of uniform age distribution. As Sraffa stresses, 'the interest of this type of price-variation is chiefly from the standpoint of capital theory' (*ibid.*, p. 72), since it is made clear that the value of a given *physical* capital stock cannot be ascertained prior to the determination of r .

Unlike capital, which consists of produced means of production derived from the production process, *natural resources*, such as land, can be taken as external elements of production, measured in their own physical units. 'Being employed in production, but not themselves produced, they are the converse of commodities which, although produced, are not used in production' (*ibid.*, p. 74), that is, the converse of non-basics that are pure consumption goods. In accordance with Ricardo's treatment of the problem under consideration, Sraffa starts from a given system of production, that is, given quantities of the commodities produced and given methods of production in use, and a given distribution of income between wages and profits. He then indicates how such a constellation can be conceived of 'as the outcome of a process of "extensive" ... [or] "intensive" diminishing returns' (*ibid.*, p. 76). Elaborating on Sraffa's approach, several contributions were concerned with the study of changes in the relations between the distributive variables (including rents) and prices, corresponding to autonomous changes in

one of the distributive variables (the rate of profits, r , or the wage rate, w) or in outputs.

Part III of Sraffa's book is devoted to a discussion of the problem of the choice of technique. There Sraffa showed that it cannot be presumed that techniques can be ordered monotonically with the rate of interest. In the Cambridge capital controversies, his findings were used in order to criticize neoclassical theory. *Reswitching* was defined as a situation in which a technique is cost-minimizing at two disconnected ranges of the rate of interest and not so in between these ranges. Samuelson emphasized that 'this phenomenon can be called "perverse" only in the sense that the conventional parables did not prepare us for it' (Samuelson, 1966, p. 578). The implication of the possibility of the reswitching of techniques is that the direction of change of the 'input proportions' cannot be related unambiguously to changes of the so-called 'factor prices'. The central element of the neoclassical explanation of distribution in terms of supply and demand is thus revealed as defective. The demonstration that a fall in the wage rate (that is, a rise in the rate of interest) may lead to the adoption of the less 'labour-intensive', that is, more 'capital-intensive', of two techniques destroyed, in the minds of the critics of neoclassical theory, its concept of substitution in production. Moreover, since a fall in the wage rate may cheapen some of the commodities, the production of which at a higher level of the wage rate was characterized by a relatively low labour intensity, the substitution among consumption goods contemplated by the traditional theory of consumer demand may result in a higher, as well as in a lower, labour intensity. It follows that the principle of substitution in consumption cannot offset the breakdown of the conventional principle of substitution in production.

We talk of 'reverse capital deepening' when the relationship between the *value* of capital (per head), expressed in terms of a given consumption unit, and the rate of interest is increasing. The negative implication of reswitching and reverse capital deepening for traditional theory can be illustrated by means of the example in Figure 1, in which the value of capital (in terms of the consumption unit) corresponding to the full employment level of labour is plotted against the rate of profits. Obviously, if with traditional analysis we would be prepared to conceive of the curve KK' as the 'demand curve' for capital, which, together with the corresponding 'supply curve' K^*K^{*} , is taken to determine the equilibrium value of the rate of interest, r , we would have to conclude that this equilibrium, although unique, is unstable. With free competition, conceived of, as it is in neoclassical theory, as including the perfect flexibility of the distributive variables, a deviation of r from r^* would lead to the

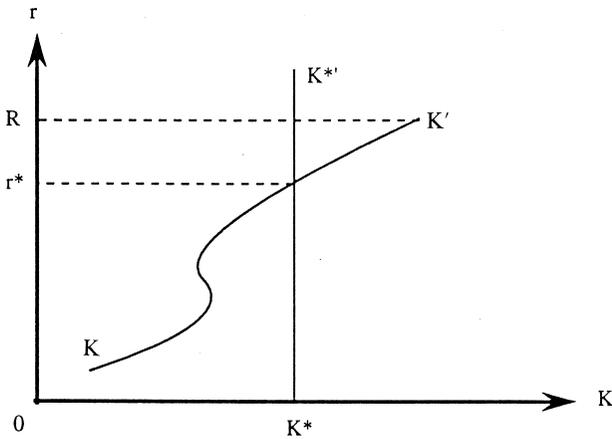


Figure 1

absurd conclusion that one of the two income categories, wages or profits, would disappear.

In the Preface to *Production of Commodities*, Sraffa stressed that he had not introduced any assumption on returns in the book since it was not concerned with *changes* either in the *scale of production* or in the *proportions* in which the 'factors of production' are employed (1960, p. v). The effects of these changes on the costs of production were central to his critique of Marshall's supply functions in the 1920s.⁶ A comparison of that critique with *Production of Commodities* shows that in both the reference is essentially to the same determinants of variable returns. That is, Sraffa's analysis of the relationship between quantities produced and prices is carried out in terms of basically the same factors. Panico and Salvadori (1994) provided a detailed account of this fact (see also Kurz and Salvadori, 1995, pp. 418–21).

5 The consequences of Mr. Sraffa

As has variously been indicated, each of Sraffa's published contributions had some remarkable consequences and led to important developments in economics. In this concluding section we shall briefly sketch the impact

⁶ In the 1925 article, it is stated that increasing returns are related to *changes in the scale of production* whereas diminishing returns are related to *changes in the proportions* in which 'factors' are employed.

of his 1960 book. There is no presumption that the following account is complete.

It is hardly an exaggeration to say that the capital controversies in the 1960s and 1970s were essentially the result of Sraffa's contribution to the theory of value and distribution. While it is true that the controversy was started with a paper by Joan Robinson (1953), she made it clear that much of what she had to say she had learned in private conversations with Sraffa. He was indeed the *spiritus rector* of the Cambridge, UK, side. His work inspired many scholars and led to swift developments in several areas of research. Major achievements concern: (i) the elaboration of the concepts of vertical integration and reduction to dated quantities of labour; (ii) the analysis of the problem of the choice of technique in a general framework; (iii) the theory joint production with and without the 'Rule of Free Goods'; (iv) the theory of fixed capital, including the case of jointly utilized machines; (v) the theory of rent and of exhaustible resources; (vi) the analysis of different forms of technical progress; (vii) the theory of foreign trade; (viii) the analysis of the gravitation of market prices to 'natural' prices. Several received doctrines were scrutinized and shown to be tenable only in special cases. These include: (i) the Marxian labour value-based approach to the theory of the rate of profits and relative prices; (ii) the traditional long-period marginal productivity theory of value and distribution; (iii) the Heckscher–Ohlin–Samuelson theory of international trade (see, in particular, Garegnani, 1960, 1970, 1990; Pasinetti, 1977, 1980; Schefold, 1971, 1989, 1997; Steedman, 1977, 1979, 1988; Quadrio-Curzio, 1967; Mainwaring, 1984; Salvadori, 1988; Salvadori and Steedman, 1990; Kurz, 1990; Eatwell, Milgate and Newman, 1990; Bharadwaj and Schefold, 1990; Caminati and Petri, 1990; Bidard, 1991; Kurz and Salvadori, 1995, 1998a, 1998b).

However, Sraffa's contributions also inspired many of those who advocated one version or another of marginalism. These scholars had to face the criticisms put forward, and in doing so they came up with new results and new interpretations of old ones. It was Paul A. Samuelson, in particular, who tirelessly took on the challenge and wrote several essays dealing with Sraffa's contributions (see, in particular, Samuelson, 1962, 1966, 1975, 1987, 1991). He also showed that certain findings were anticipated in his earlier works (see, especially, Samuelson, 1957, 1959; see also Bruno, Burmeister and Sheshinski, 1966; Burmeister, 1980; Hahn, 1982). It was particularly Samuel Hollander who questioned Sraffa's interpretation of the classical economists (see Hollander, 1973, 1979, 1995).

It is to be hoped that this volume will contribute to a clarification of at least some of the questions raised and thereby release energies to pursue

promising directions of research. The time of its publication marks a watershed in the interpretation of Sraffa's contributions, because it is to be expected that within the next couple of years a selection of Sraffa's hitherto unpublished manuscripts and correspondence will come out. In the light of this material, which is both huge and very complex, some interpretations will turn out to be untenable, others will have to be modified somewhat and in some respects entirely new interpretations will have to be sought. Adapting Sen's well-known dictum, cited in the Preface, we may say that Sraffa apparently found it immoral to *publish* more than one page per month. The group of scholars who are preparing the edition of his manuscripts and correspondence would be ill-advised to follow this maxim.

References

- Bharadwaj, K. and Schefold, B. (eds) (1990). *Essays on Piero Sraffa: Critical Perspectives on the Revival of Classical Theory*, London: Unwin Hyman. (Second printing London 1992: Routledge.)
- Bidard, Ch. (1991). *Prix, reproduction, rareté*, Paris: Dunod.
- Bruno, M., Burmeister, E. and Sheshinski, E. (1966). 'The Nature and Implications of the Reswitching of Techniques', *Quarterly Journal of Economics*, **80**, pp. 526–53.
- Burmeister, E. (1980). *Capital Theory and Dynamics*, Cambridge: Cambridge University Press.
- Caminati, M. and Petri, F. (eds) (1990). *Convergence to Long-Period Positions*, Special issue of *Political Economy. Studies in the Surplus Approach*, **6**.
- De Vivo, G. (1996). 'Ricardo, Torrens, and Sraffa: A Summing Up', *Cambridge Journal of Economics*, **20**, 387–91.
- Eatwell, J., Milgate, M. and Newman, P. (eds) (1990). *Capital Theory*, London: Macmillan.
- Eatwell, J. and Panico, C. (1987). 'Sraffa, Piero', in J. Eatwell, M. Milgate and P. Newman (eds), *The New Palgrave: A Dictionary of Economics*, London: Macmillan, Vol. 4, pp. 445–52.
- Garegnani, P. (1960). *Il capitale nelle teorie della distribuzione*, Milan: Giuffrè.
- Garegnani, P. (1970). 'Heterogeneous Capital, the Production Function and the Theory of Distribution', *Review of Economic Studies*, **37**, pp. 407–36.
- Garegnani, P. (1990). 'Quantity of Capital', in J. Eatwell, M. Milgate and P. Newman (1990), pp. 1–78.
- Hahn, F. H. (1972). *The Share of Wages in the National Income: An Enquiry into the Theory of Distribution*, London: Weidenfeld and Nicolson.
- Hahn, F. H. (1982). 'The Neo-Ricardians', *Cambridge Journal of Economics*, **6**, pp. 353–74.
- Harcourt, G. C. (1972). *Some Cambridge Controversies in the Theory of Capital*, Cambridge: Cambridge University Press.
- Hayek, F. A. (1931a). *Prices and Production*, 1st edn, London: George Routledge (2nd edn London 1935).

- Hayek, F. A. (1931b). 'Reflections on the Pure Theory of Money of Mr. J. M. Keynes', *Economica*, **11**, pp. 270–95.
- Hayek, F. A. (1932). 'Money and Capital: A Reply', *Economic Journal*, **42**, pp. 237–49.
- Hollander, S. (1973). *The Economics of Adam Smith*, Toronto: Toronto University Press.
- Hollander, S. (1979). *The Economics of David Ricardo*, Toronto: Toronto University Press.
- Hollander, S. (1995). 'Sraffa's Rational Reconstruction of Ricardo: On Three Contributions to the *Cambridge Journal of Economics*', *Cambridge Journal of Economics*, **19**, pp. 483–9.
- Hume, D. (1938). *An Abstract of a Treatise on Human Nature*, edited, with an introduction, by J. M. Keynes and P. Sraffa, London. The introduction is reprinted in Keynes, *CW*, XXVIII, pp. 373–90.
- Keynes, J. M. (1973). *The Collected Writings of John Maynard Keynes*, edited by D. Moggridge, Vols I–XXX, London: Macmillan. (Referred to as *CW*, volume number, page number.)
- Kurz, H. D. (1986). 'Classical and Early Neoclassical Economists on Joint Production', *Metroeconomica*, **38**, pp. 1–37.
- Kurz, H. D. (1990). *Capital, Distribution and Effective Demand. Studies in the 'Classical' Approach to Economic Theory*, Cambridge: Polity Press.
- Kurz, H. D. (1998). 'Against the Current: Sraffa's Unpublished Manuscripts and the History of Economic Thought', *European Journal of the History of Economic Thought*, **5**, pp. 437–51.
- Kurz, H. D. and Salvadori, N. (1993). 'The "Standard Commodity" and Ricardo's Search for an "Invariable Measure of Value"', in M. Baranzini and G. C. Harcourt (eds), *The Dynamics of the Wealth of Nations. Growth, Distribution and Structural Change. Essays in Honour of Luigi Pasinetti*, New York: St. Martin's Press, pp. 95–123.
- Kurz, H. D. and Salvadori, N. (1995). *Theory of Production. A Long-Period Analysis*, Cambridge, Melbourne and New York: Cambridge University Press.
- Kurz, H. D. and Salvadori, N. (1997). 'On Critics and Protective Belts', in A. Salanti and E. Screpanti (eds), *Pluralism in Economics*, Aldershot: Edward Elgar, pp. 232–55.
- Kurz, H. D. and Salvadori, N. (1998a). *Understanding 'Classical' Economics. Studies in Long-Period Theory*, London: Routledge.
- Kurz, H. D. and Salvadori, N. (eds) (1998b). *The Elgar Companion to Classical Economics*, 2 vols., Aldershot: Edward Elgar.
- Mainwaring, L. (1984). *Value and Distribution in Capitalist Economies. An Introduction to Sraffian Economics*, Cambridge: Cambridge University Press.
- Panico, C. (1991). 'Some Notes on Marshallian Supply Functions', *Economic Journal*, **101**, pp. 557–69.
- Panico, C. and Salvadori, N. (1994). 'Sraffa, Marshall and the Problem of Returns', *The European Journal of the History of Economic Thought*, **1**, pp. 323–43.
- Pasinetti, L. L. (1977). *Lectures on the Theory of Production*, London: Macmillan.
- Pasinetti, L. L. (ed.) (1980). *Essays on the Theory of Joint Production*, London: Macmillan.

- Pollit, B. H. (1990). 'Clearing the Path for "Production of Commodities by Means of Commodities": Notes on the Collaboration of Maurice Dobb in Piero Sraffa's Edition of the "Works and Correspondence of David Ricardo"', in Bharadwaj and Schefold (1990), pp. 516–28.
- Potier, J.-P. (1991). *Piero Sraffa Unorthodox Economist (1898–1983): A Biographical Essay*, London: Routledge.
- Quadrio-Curzio, A. (1967). *Rendita e distribuzione in un modello economico pluri-settoriale*, Milano: Giuffrè.
- Ricardo, D. (1951–73). *The Works and Correspondence of David Ricardo*, 11 vols, edited by P. Sraffa with the collaboration of M. H. Dobb, Cambridge: Cambridge University Press. (In the text quoted as *Works*.)
- Robinson, J. V. (1933). *Economics of Imperfect Competition*, London: Macmillan.
- Robinson, J. V. (1953). 'The Production Function and the Theory of Capital', *Review of Economic Studies*, **21**, pp. 81–106.
- Roncaglia, A. (1978). *Sraffa and the Theory of Prices*, New York: John Wiley.
- Salvadori, N. (1988). 'Fixed Capital within the Sraffa Framework', *Zeitschrift für Nationalökonomie*, **48**, pp. 1–17.
- Salvadori, N. and Steedman, I. (eds) (1990). *Joint Production of Commodities*, Aldershot: Edward Elgar.
- Samuelson, P. A. (1957). 'Wages and Interest: A Modern Dissection of Marxian Economic Models', *American Economic Review*, **47**, pp. 884–912.
- Samuelson, P. A. (1959). 'A Modern Treatment of the Ricardian Economy. I. The Pricing of Goods and of Labor and Land Services. II. Capital and Interest Aspects of the Pricing Process', *Quarterly Journal of Economics*, **73**, pp. 1–35 and 217–31.
- Samuelson, P. A. (1962). 'Parable and Realism in Capital Theory: The Surrogate Production Function', *Review of Economic Studies*, **29**, pp. 193–206.
- Samuelson, P. A. (1966). 'A Summing Up', *Quarterly Journal of Economics*, **80**, pp. 568–83.
- Samuelson, P. A. (1975). 'Trade Pattern Reversals in Time-Phased Ricardian Systems and Intertemporal Efficiency', *Journal of International Economics*, **5**, pp. 309–63.
- Samuelson, P. A. (1987). 'Sraffian Economics', in J. Eatwell, M. Milgate, and P. Newman (eds), *The New Palgrave: A Dictionary of Economics*, London: Macmillan, Vol. 4, pp. 452–61.
- Samuelson, P. A. (1991). 'Sraffa's Other Leg', *Economic Journal*, **101**, pp. 570–4.
- Schefold, B. (1971). *Mr. Sraffa on Joint Production*, Ph.D. Thesis, University of Basle, mimeo.
- Schefold, B. (1989). *Mr. Sraffa on Joint Production and Other Essays*, London: Unwin Hyman.
- Schefold, B. (1996). 'Piero Sraffa 1898–1983', *Economic Journal*, **106**, pp. 1314–25.
- Schefold, B. (1997). *Normal Prices, Technical Change and Accumulation*, Houndmills, Basingstoke and London: Macmillan.
- Smith, A. (1976). *An Inquiry into the Nature and Causes of the Wealth of Nations*, 1st edn 1776, Vol. II of *The Glasgow Edition of the Works and Correspondence of Adam Smith*, edited by R. H. Campbell, A. S. Skinner and W. B. Todd, Oxford: Oxford University Press. (In the text quoted as *WN*.)
- Sraffa, P. (1922). 'The Bank Crisis in Italy', *Economic Journal*, **32**, pp. 178–97.