MR. SRAFFA'S REHABILITATION OF CLASSICAL ECONOMICS[1]

I

Mr. Sraffa's important new book, *Production of Commodities by Means of Commodities*,[2] is described in the publisher's blurb as 'a work of a specialist character, addressed to those interested in pure economic theory'. One should not be intimidated by this, however; the book is a short one, running to less than 100 pages; the argument is on the whole quite lucid; and the mathematics used is of a very elementary character. Nevertheless, the problems with which the book deals are from their very nature rather complex and abstract; and some of Sraffa's analytical tools and methods are likely to appear strange to those unversed in the ways of Ricardo and Marx. The present article is an attempt to summarise Sraffa's main argument and to state in simple language just what I think he is getting at.

The book can be looked at from various points of view. It can be regarded, if one pleases, simply as an unorthodox theoretical model of a particular type of economy, designed to solve the traditional problem of value in a new way—in which case it will be judged purely on its own merits. Or it can be regarded as an implicit attack on modern marginal analysis: the sub-title of the book is 'Prelude to a Critique of Economic Theory', and Sraffa in his preface expresses the hope that someone will eventually attempt the job of basing a critique of the marginal analysis on his foundations. Or, finally, the book can be regarded as a sort of magnificent rehabilitation of the classical approach to certain crucial problems relating to value and distribution. It is upon this third aspect of the book that I am concentrating in the present article. In doing so, I do not of course want to suggest that the *essence* of Sraffa's book lies in this rehabilitation of the classical approach: Sraffa's primary aim is not to show that there's life in the old dogs yet, but to build a 20th-century model to deal with 20th-century problems. I am approaching his book in

[1] This article is based on a lecture given at the University College of North Wales, Bangor, on 21 November 1960. It owes much to the criticisms of Mr. Maurice Dobb and Mr. John Eaton, who must not, however, be held responsible for any errors which remain.

[2] Cambridge University Press, 1960. 12s. 6d.

this particular way simply because I think it affords the best method of understanding Sraffa's basic argument.

Let me begin by making three general points about the relation between Sraffa's model and the old classical models. First, both Sraffa's model and the classical models are concerned with the investigation of one and the same set of properties of an economic system—those properties, as Sraffa puts it, which 'do not depend on changes in the scale of production or in the proportions of "factors"'.[3] The classical people, at any rate in their basic analysis of the economy as such, were usually *in effect* concerned with these properties alone, since they often tended to assume that under given technological conditions returns to scale for the industry as a whole would be constant,[4] and that the proportions in which the different means of production were used in an industry would be technically fixed. Sraffa, by way of distinction, makes no assumption whatever about the variability or constancy of returns. Rather, he simply selects for analysis a particular kind of economic system in which the question of whether returns are variable or constant is irrelevant. This system is one in which production goes on from day to day and from year to year in exactly the same way, without any changes in scale or 'factor' proportions at all. By this means Sraffa is able *deliberately* to concern himself with the investigation of the same properties of an economic system which the classical people *objectively* concerned themselves with, while at the same time avoiding the necessity of making any (possibly objectionable) assumptions about the nature of returns.

The second point is this: The classical people, anxious as they were to propound generalised statements or 'laws' relating to the economy in which they were interested, naturally wanted to make their systems 'determinate' in some useful and meaningful sense of that word. The methods they employed to secure the requisite degree of determinacy were often ingenious and stimulating. But they did not hit on the idea that it would help greatly to secure determinacy if certain specific interrelations were postulated between elements of input and elements of output over the economy as a whole, so that the output of certain industries was assumed to constitute the input of others. They were of course aware that such interrelations did exist and were important: Quesnay, after all, framed his *Tableau Economique;* Marx worked out his famous reproduction schemes; and

[3] Sraffa, p. v.
[4] I.e., roughly, that a change in the size of an industry would not alter the unit cost of producing the commodity concerned.

Ricardo (if Sraffa is right) held at one stage a 'corn-ratio theory of profits'.[5] The point I am making is simply that they did not, by and large, use these postulated interrelationships as an integral part of the methods which they employed to make prices and 'factor' incomes determinate—i.e., to solve the general problem of value. And this is precisely what Sraffa *does* do.[6]

The third point is this: The classical people were primarily interested in the problem of the *development* of the capitalist system, but they believed that a necessary preliminary to the study of this problem was an analysis of *the nature of the capitalist system as such.* And the best method of going about this analysis, they believed, was to begin by imagining capitalism suddenly impinging upon a pre-capitalist form of economy in which, in effect, labour was the only 'factor' receiving a reward. In this pre-capitalist economy, which Smith called the 'early and rude state of society' and Marx called 'simple commodity production', the whole produce of labour went to the labourers.[7] In such an economy, it was claimed, the relative equilibrium prices of commodities would tend to be equal to the relative quantities of labour required from first to last to produce them. What happened, then, when a class of capitalists arrived on the scene, and the net product of the economy consequently came to be shared between labourers and capitalists? In particular, what happened to relative equilibrium prices? Did they remain equal to relative quantities of embodied labour, or did they now diverge from these quantities? If they diverged, were the divergences haphazard, or could they be shown to be in some useful sense 'subject to law'? Did the divergences render it necessary to throw out the simple 'law of value' which used to operate in the pre-capitalist economy, or could they be regarded as merely *modifying* its operation? These questions were not regarded as purely academic ones, with little relevance to problems of practical policy. On the contrary, the classical people believed that if one could give adequate answers to them one would then have penetrated to the very essence of the capitalist system, and would be properly equipped to proceed to the major task—that of the determination of what Marx (and Mill) called the 'laws of motion' of the capitalist system. The general procedure which Sraffa adopts, and the questions he asks, are very similar to those I have just described.

[5] Sraffa, p. 93.
[6] The specialist will notice the intellectual affinity between Sraffa's approach and that of the Walrasian-type analysis and modern 'input-output' techniques.
[7] Cf. Adam Smith, *Wealth of Nations* (Cannan edn.), Vol. I, pp. 49 and 66.

II

Sraffa begins with a very simple model of a subsistence economy in which there are only two commodities produced—wheat and iron—and in which the total amount of each of these commodities which goes into the productive process each year is precisely the same as the total amount which comes out.[8] A possible set of conditions of production in such an economy is as follows:

$$\begin{array}{l} 280 \text{ qr. wheat} + 12 \text{ t. iron} \rightarrow 400 \text{ qr. wheat} \\ 120 \text{ qr. wheat} + 8 \text{ t. iron} \rightarrow 20 \text{ t. iron} \\ \overline{400} \qquad\qquad\quad \overline{20} \end{array}$$

In the wheat industry (represented by the first line) 280 quarters of wheat and 12 tons of iron are used up during the year in order to produce an annual output of 400 quarters of wheat. In the iron industry (represented by the second line) 120 quarters of wheat and 8 tons of iron are used up during the year in order to produce an annual output of 20 tons of iron.[9] It will be seen that a total of 400 quarters of wheat and 20 tons of iron goes into the productive process and is used up there, and that 400 quarters of wheat and 20 tons of iron come out of the productive process at the end of the year.

Now, at the end of each year the wheat producers are going to have 400 quarters of wheat in their hands, 280 quarters of which have to be earmarked for the following year's input. If the process of production is to continue from year to year at the same level, it is clear that the proceeds from the sale of the remaining 120 quarters of wheat must be sufficient to enable the wheat producers to buy the 12 tons of iron which they will need as input in the following year. Similarly, the iron producers are going to have 20 tons of iron in their hands, 8 tons of which have to be earmarked for the following year's input. If the process of production is to continue from year to year at the same level, it is clear that the proceeds from the sale of the remaining 12 tons of iron must be sufficient to enable the iron producers to buy the 120 quarters of wheat which they will need as input in the following year. It is evident, therefore, that prices in this economy must be such that 12 tons of iron are exchangeable on the market for 120 quarters of wheat—i.e., that the price of a ton of iron must be ten times the price of a quarter of wheat. This analysis can readily be generalised to cover the case of a more complex subsistence economy

[8] Sraffa, pp. 3-5.

[9] We assume for the moment that subsistence goods for the labourers are included in the wheat and iron inputs.

in which any number k of different commodities is produced. A set of k production equations in price terms can be drawn up in which the number of independent equations is equal to the number of unknowns, so that the prices of all the commodities produced become determinate.[10]

Let us now drop the assumption of a subsistence economy, and turn, as Sraffa does,[11] to the case of an economy in which a surplus over subsistence is yielded. Such an economy might be one with the following conditions of production:

$$\begin{array}{lcl} 280 \text{ qr. wheat} + 12 \text{ t. iron} & \rightarrow & 575 \text{ qr. wheat} \\ 120 \text{ qr. wheat} + \ \ 8 \text{ t. iron} & \rightarrow & \ \ 20 \text{ t. iron} \\ \overline{400} \qquad\qquad\quad \overline{20} & & \end{array}$$

It will be seen that this economy is the same as the previous one except that the wheat industry is now assumed to produce 575 quarters of wheat every year instead of 400. If we assume that the rewards going to labour are fully taken care of in the wheat and iron inputs of the two industries, as we have so far been doing,[12] this means that the whole value of the surplus of 175 quarters of wheat will be available for distribution in the form of profit. Let us assume that this profit is distributed in such a way as to make the *rate* of profits equal in both industries—in other words, that the owners of each industry earn what the classical economists called the 'normal' or 'average' rate of profits on their advances. The situation now is that prices must be such as to allow the elements of input in each industry to be replaced, *and* to allow profits on the value of these elements of input to be earned at the same rate in each industry. In the present example, these two conditions will be fulfilled if prices are such as to make 1 ton of iron exchangeable on the market for 15 quarters of wheat, which will bring the average rate of profits out at 25 per cent.[13] Once again this analysis can readily be generalised to cover the case of a more complex economy in which any number k of different commodities is

[10] Specialists will appreciate that any one of the k equations can be inferred from the sum of the others, so that there are in fact only $k-1$ *independent* equations. But it is easy to reduce the number of unknowns to $k-1$ by taking one commodity as the standard of value and making its price equal to unity. See Sraffa, p. 5.

[11] Sraffa, pp. 6 ff.

[12] See n. 9.

[13] Let the price of a quarter of wheat be 1: let the price of a ton of iron be p_i; and let the average rate of profits be r. The production equations in price terms will then read as follows:

$$(280+12.p_i)(1+r)=575$$
$$(120+\ 8.p_i)(1+r)=\ 20.p_i$$

These equations yield the solutions $p_i=15$ and $r=\frac{1}{4}$.

produced. A set of k production equations in price terms can be drawn up in which the number of independent equations is equal to the number of unknowns, so that the prices of the k commodities, *and* the average rate of profits, are all determined.[14]

We must now alter the assumption we have so far been making about wages. Up to this point we have in effect assumed that wages consist of necessary means of subsistence for the workers, and thus, as Sraffa puts it, enter the system 'on the same footing as the fuel for the engines or the feed for the cattle'.[15] But wages may in fact include not only the 'ever-present element of subsistence' (which is constant), but also a 'share of the surplus product' (which is variable).[16] What is one to do about this? The most appropriate thing to do would be to separate the wage into its two component parts, continuing to treat the goods required for the subsistence of the workers as means of production along with the fuel, fodder, etc., and treating the variable element in the wage as a part of the surplus product of the system. Sraffa, however, in order to avoid 'tampering with the traditional wage concept', from now on treats the whole of the wage as variable—i.e., as part of the surplus product. This means that the quantity of labour employed in each industry has from now on to be represented explicitly in our statements of the conditions of production, taking the place of the corresponding quantities of subsistence goods in our previous statements.

When the wage is recognised as containing a variable element, or when, as with Sraffa, the whole of the wage is assumed to be variable, we have another unknown to be added to our list. In a system where k commodities are produced, we now have $k+2$ unknowns—the k prices, the rate of profits r, and the wage w.[17] And the best we can do, when we put the production equations in price terms, is to provide $k+1$ equations in order to find these $k+2$ unknowns. Thus the system is not determinate, unless one of the variables can be taken as fixed.[18]

[14] There are k independent equations, which, if one commodity is taken as the standard of value and its price made equal to unity, are sufficient to determine the $k-1$ prices and the rate of profits r.

[15] Sraffa, p. 9.

[16] This implies that Sraffa is defining the 'surplus product' of a system as the difference between gross output and what Ricardo called 'the absolutely necessary expenses of production.'

[17] 'We suppose labour to be uniform in quality or, what amounts to the same thing, we assume any differences in quality to have been previously reduced to equivalent differences in quantity so that each unit of labour receives the same wage' (Sraffa, p. 10).

[18] Let A be the quantity annually produced of commodity 'a'; let B be the quantity annually produced of commodity 'b'; and so on. Let A_a, B_a, . . . , K_a be the quantities of commodities 'a', 'b', . . . , 'k' annually used as means of production by the industry which produces A; let A_b, B_b, . . . ,

As Sraffa puts it, 'the system can move with one degree of freedom; and if one of the variables is fixed the others will be fixed too'.[19] In particular, if we know what the wage is, the rate of profits and all the prices will be determined.

III

Having erected this simple model, Sraffa now proceeds to investigate what we have seen to be the basic classical problem—what happens to prices and profits when a class of capitalists arrives on the scene to share the net product of the economy with labour? Sraffa deals with this problem by giving the wage successive values ranging from 1 to 0 —a wage of 1 representing a situation in which *all* the net product goes to labour (i.e., there is no class of capitalists and therefore no profit), and a wage of 0 representing the other extreme in which *none* of the net product goes to labour (i.e., there is a class of capitalists which manages to secure *all* the net product in the form of profit). The main task is to show what happens to prices and to the rate of profits as the wage is reduced from 1 to 0.

When the wage is 1—i.e., when the whole of the net product goes to wages—we in effect revert to the simple set of equations with which we started, except that (as already stated) the quantities of labour employed in each industry will now be shown explicitly in our equations instead of being represented, as they were before, by quantities of subsistence goods. It is easy to show that in this situation the equilibrium prices of the different products will be proportionate to the different quantities of labour which have been directly and indirectly employed to produce them. For if the only form of income is wages,

K_b be the quantities of commodities 'a', 'b', . . . , 'k' annually used as means of production by the industry which produces B; and so on. Let L_a, L_b, . . . , L_k be the quantities of labour annually employed in the industries producing A, B, . . . , K. These quantities are the 'knowns' in our equational system.

Let p_a, p_b, . . . , p_k be the unit prices of commodities 'a', 'b', . . . , 'k'. Let r be the average rate of profits. Let w be the wage per man. These quantities are the 'unknowns' in our equational system.

In generalised form, the production equations in price terms will read as follows:

$$(A_a.p_a + B_a.p_b + \ \dots\ + K_a.p_k)(1+r) + L_a.w = A.p_a$$
$$(A_b.p_a + B_b.p_b + \ \dots\ + K_b.p_k)(1+r) + L_b.w = B.p_b$$
$$\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots$$
$$(A_k.p_a + B_k.p_b + \ \dots\ + K_k.p_k)(1+r) + L_k.w = K.p_k$$

By putting the surplus product of the system equal to unity (thereby making it the standard in terms of which the wage and the k prices are expressed) we obtain an additional equation, making a total of $k+1$ equations. But there are $k+2$ unknowns, so that the system is not determinate unless one of the variables (e.g. the wage w) can be taken as fixed. (See Sraffa, pp. 4, 6 and 10-11.)

[19] Sraffa, p. 11.

all input-costs ultimately reduce to wage-costs. This means that the value of each end-product will be equal to the sum of its inputs at wage-cost, which of course implies (if wages are uniform) that price ratios will be equal to embodied labour ratios.[20] What this proposition amounts to, of course, is an affirmation of the truth of the Smithian, Ricardian and Marxian proposition that in the 'early and rude state of society', where there is no profit, the classical 'law of value' acts, as it were, directly, so that price ratios will in equilibrium be equal to embodied labour ratios.

Now, Smith, Ricardo and Marx, having established this proposition, went on to argue that in a capitalist society, where the net product was shared between wages and profits, prices no longer followed this simple rule. The 'law of value' which originally operated in this direct and simple way was now subject, as Ricardo put it, to important 'modifications'.[21] Sraffa, like his classical predecessors, now goes on to consider the nature and causes of these 'modifications'.

Sraffa's explanation of the basic reason for the emergence of the 'modifications' is substantially the same as that of Ricardo and Marx. 'The key to the movement of relative prices consequent upon a change in the wage', Sraffa writes, 'lies in the inequality of the proportions in which labour and means of production are employed in different industries'.[22] It is useful, I think, to begin by explaining this point in Ricardo's terms. Let us assume that we have an economy which consists of three separate industries, A, B and C, in each of which the proportions in which labour and means of production are combined together are different. In other words, the ratio of the wage-

[20] Suppose that a two-industry economy produces a gross output of 400 quarters of wheat and 25 tons of iron. Let the sum of the inputs at wage-cost in the two industries be £200 and £250 respectively. Since the value of the end-product will in each case equal the sum of its inputs at wage-cost, the price of a ton of iron will be 20 times the price of a quarter of wheat. Let the wage per man be £5. This means that 40 units of direct and indirect labour are required to produce 400 quarters of wheat, and 50 units of direct and indirect labour are required to produce 25 tons of iron. Thus 20 times as much labour is required to produce a ton of iron as is required to produce a quarter of wheat. Thus price ratios are equal to embodied labour ratios.

[21] Smith, broadly speaking, believed that the 'modifications' were so important as to render it necessary to throw out the old 'law of value' and to replace it by what amounted to a 'cost-of-production' theory of value. Ricardo agreed that the 'modifications' were important, but argued that it was still possible to say that relative prices were *mainly* determined by relative quantities of embodied labour (and, what was for him more significant, that *changes* in relative prices were mainly caused by *changes* in relative quantities of embodied labour). Marx also emphasised the importance of the 'modifications', but maintained that the old 'law of value' still *ultimately* and *indirectly* determined prices. Sraffa, as will be shown in the last part of this article, in effect follows Marx's line of approach to this problem.

[22] Sraffa, p. 12.

bill to the value of used-up means of production is different in each industry. Such an economy might be the following:

	Value of Used-up Means of Production		*Wages*		*Price*
A.	800	+	200	=	1000
B.	600	+	400	=	1000
C.	200	+	800	=	1000

Wages, we begin by assuming, absorb the whole of the net product, profits being zero. Under these circumstances, the price of the finished product will in each case be 1000, as indicated in the table.

Now, suppose that a class of capitalists arrives on the scene and shares in the net product along with labour. Wages, let us assume, go down by one-half, and as a result of this profits rise from zero to a level which affords an average rate of, let us say, 25 per cent. on the value of the means of production. (We leave aside for the moment the important question of how far profits will *in fact* rise as a result of this particular wage-reduction: we simply assume that they will rise from zero to an arbitrarily-chosen figure of 25 per cent.) The price of each commodity will now be made up of the value of the means of production employed (which we assume for the moment to remain at its original level), plus the wage-bill (now cut by one-half in each case), plus profit at 25 per cent. on the value of the means of production. The situation will then be as follows:

	Value of Used-up Means of Production		*Wages*		*Profits*		*Price*
A.	800	+	100	+	200	=	1100
B.	600	+	200	+	150	=	950
C.	200	+	400	+	50	=	650

It is clear that under these circumstances the prices of the three commodities would have to change from their original levels. If the price of the product of industry A remained at 1000, that industry would show a sort of 'deficit': it would not be able to pay wages at the given rate and at the same time receive profits at the given rate on its means of production. Similarly, if the prices of the products of industries B and C remained at 1000, these industries would show a sort of 'surplus': they would secure receipts which were more than sufficient to pay wages at the given rate and to earn profits at the given rate on their means of production. Therefore prices would clearly have to alter to the levels indicated in the second table above. The relative prices of the three commodities would change in this case, when the wage changed, simply because the proportions in which labour and the means of production are combined in the three industries are different. If these proportions were the same in each case, it is easy to show that relative prices would not change at all from their previous level.[23]

Now, it *looks* from this example as if we could frame a simple general rule about what happens to prices when wages fall. Could we not say that the price of the product of an industry with a relatively low proportion of labour to means of production, like industry A in our example, would rise when wages fell; and that the price of the product of an industry with a relatively high proportion of labour to means of production, like industries B and C in our example, would fall when wages fell? This is in effect what Ricardo said. But this need not in fact necessarily be so. It certainly *looks* from our example as if the price of the product of industry B, say, is bound to fall. But we have so far assumed, as Ricardo usually did, that the value of the means of production employed in industry B remains the same as it was initially—i.e., at 600—in spite of the fall in wages. But suppose that these means of production employed in industry B were themselves produced by an industry like A in our example, where the proportion of labour to means of production is relatively low. The price of the means of production employed in B would then rise when wages fell, so that the price of the *product* of industry B, instead of falling as it does in our example, might actually rise. Thus the movements in the relative prices of any two products, consequent upon a change in wages, come to depend, as Sraffa puts it, ' 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 '.[24]

Now, we could imagine that an industry existed which represented a sort of ' borderline ' between the ' deficit ' and ' surplus ' industries which we have just distinguished. In such an industry, as Sraffa puts it, ' the proceeds of the wage-reduction would provide exactly what was required for the payment of profits at the general rate '.[25]

[23] Take, for example, a situation in which industry A uses up 400 means of production and pays out 800 in wages; industry B uses up 300 means of production and pays out 600 in wages; and industry C uses up 200 means of production and pays out 400 in wages. The prices of the three products in the initial situation will be 1200, 900 and 600—i.e., they will stand to one another in the ratio 4:3:2. If wages fall by one-half and profits as a result rise from zero to 25 per cent., the prices of the products will become 900, 675 and 450 respectively—i.e., they will still stand to one another in the ratio 4:3:2.

[24] Sraffa, p. 15.

[25] Sraffa, p. 13.

Suppose, for example, that there was an industry which employed labour and means of production in such a proportion that on the basis of the initial prices of the means of production the proceeds of the wage-reduction provided exactly the amount that was required to pay profits at the average rate—instead of something less, as in our industry A, or something more, as in our industries B and C. Suppose further—and this is the vital point—that the means of production which this industry employed were themselves produced by labour and means of production in the same proportion, and so on right down the line. There would be nothing in the conditions of production of such an industry which would make its product rise or fall in value relative to any other commodity when wages rose or fell. And the value of such a commodity relative to the value of its own means of production could not possibly change, since the same 'proportions' would by hypothesis apply in the case of these means of production, *their* means of production, and so on right down the line. Thus one way of expressing the quality of 'invariance' which the product of this borderline industry would possess is to say that the ratio of the value of the industry's net product to the value of its means of production would always remain the same whatever change took place in the wage. And it is easy to show that this ratio must be equal to the average rate of profits which would prevail over the economy as a whole if wages were zero[26]—the 'maximum rate of profits', as Sraffa calls it. Sraffa uses the term 'R' to refer both to the ratio of the value of the net product of the borderline industry to the value of its means of production, and to the 'maximum rate of profits'. So we have:

$$\frac{\text{Value of net product of borderline industry}}{\text{Value of its means of production}} = \text{`Maximum rate of profits'} = R$$

Having set out in a general way the basic condition of an 'invariant' industry, Sraffa now proceeds to ask whether an industry fulfilling this condition could in fact be found. No actual industry in the economy is likely to fulfil the requirements; but, Sraffa argues, a mixture of industries, or of bits of industries, would do just as well. His next task, therefore, is to show that it is in fact possible to distil, from any actual economy, a sort of composite industry in which the

[26] If the wage fell to zero, the ratio of the value of the net product of the borderline industry to the value of its means of production would become equivalent to the rate of profits in the borderline industry, and by hypothesis this ratio cannot change. Thus if wages are zero, prices in the rest of the economy must so change as to bring the average rate of profit into equality with the ratio of the value of the net product of the borderline industry to the value of its means of production.

ratio of net product to means of production will remain invariable in the face of any change in the wage. Let us take a simple example of the distillation operation which Sraffa undertakes in order to obtain a composite industry which fulfils this basic condition. Take the economy whose conditions of production in physical terms are as follows:

$$\begin{array}{l} 375 \text{ qr. wheat} + \ \ 6 \text{ t. iron} \rightarrow 750 \text{ qr. wheat} \\ 300 \text{ qr. wheat} + 24 \text{ t. iron} \rightarrow \ \ 40 \text{ t. iron} \\ \overline{675} \qquad\qquad\quad \overline{30} \end{array}$$

The net product of this economy consists of 10 tons of iron plus 75 quarters of wheat. Now, suppose that we separate off *two-thirds* of the wheat industry and *one-half* of the iron industry, and treat the two resultant fractions of these industries as constituting together a sort of composite industry.[27] The conditions of production of this composite industry would be as follows:

$$\begin{array}{l} 250 \text{ qr. wheat} + \ \ 4 \text{ t. iron} \rightarrow 500 \text{ qr. wheat} \\ 150 \text{ qr. wheat} + 12 \text{ t. iron} \rightarrow \ \ 20 \text{ t. iron} \\ \overline{400} \qquad\qquad\quad \overline{16} \end{array}$$

Let us now identify the crucial ratio of net product to means of production in this composite industry. The net product consists of 4 tons of iron plus 100 quarters of wheat; and the means of production consist of 16 tons of iron plus 400 quarters of wheat. Thus the ratio is:

$$\frac{4 \text{ t. iron} + 100 \text{ qr. wheat}}{16 \text{ t. iron} + 400 \text{ qr. wheat}}$$

The numerator and denominator of this ratio, it will be noticed, are made up of quantities of the same commodities combined in the same proportions, which means that we can speak of a ratio between the two sets of commodities without the need to reduce them to the common measure of price. The ratio is of course one-quarter. And it is clear that this ratio would remain the same whatever the *prices* of the two commodities happened to be. The ratio between the two sets of commodities in *price* terms would always be the same as it is in *physical* terms—one-quarter. In other words, even though wages altered and prices subsequently changed, the ratio of the value of the net product of this composite or 'standard' industry to the value of

[27] We leave aside for the moment the question of how the appropriate multiplying fractions are arrived at.

its means of production would necessarily remain unchanged. Thus this industry would fulfil the basic condition of invariance which we have already established.

By what subtle magic has this rather startling result been obtained? We have obtained it because the fractions which we selected as our multipliers were cunningly chosen so that in the reduced-scale system the proportions in which the two commodities are produced (20:500) are the same as those in which they enter the aggregate means of production (16:400). It is only because the multiplying fractions which we chose were such as to yield us a reduced-scale system possessing this particular property that the numerator and denominator of the ratio of net product to means of production have come to consist of quantities of the same commodities combined in the same proportions, so that the ratio necessarily remains invariant to price changes. Sraffa now proceeds to show very elegantly that there is always a set of multipliers, and never more than one set, which when applied to the industries of any actual economy will rearrange them in the 'right' proportions.

Let us now consider what happens to the rate of profits *in the composite or 'standard' industry* when the wage changes. If we write R (as before) for the ratio of net product to means of production, r for the rate of profits, and w for the proportion of the net product going to wages, the relation between wages and profits in the 'standard' industry can be expressed in the form of the following simple relation:

$$r = \mathrm{R}(1-w)$$

Take as an example the 'standard' industry which we have just considered, where $\mathrm{R}=\frac{1}{4}$. Suppose that three-quarters of the net product (i.e., 3 t. iron+75 qr. wheat) went to wages, so that the remaining one-quarter (i.e., 1 t. iron+25 qr. wheat) went to profits. The rate of profits would then be:

$$\frac{1 \text{ t. iron} + 25 \text{ qr. wheat}}{16 \text{ t. iron} + 400 \text{ qr. wheat}} \quad (=1/16)$$

And this rate of profits of 1/16, or $6\frac{1}{4}$ per cent., is clearly given by the expression $r=\mathrm{R}(1-w)$, where $\mathrm{R}=\frac{1}{4}$ and $w=\frac{3}{4}$. What this expression says, in essence, is that the rate of profits *in the 'standard' industry* increases in direct proportion to the total deduction made from the wage, the extent of the increase depending on the value of R.

Now comes the final stage in this highly ingenious and persuasive argument. Sraffa maintains that this relation between wages and profits is not limited to our imaginary 'standard' system, but can also be extended to the actual economic system from which the 'standard' system has been derived. For the actual system, Sraffa argues, consists of the same basic equations as the 'standard' system, only in different proportions, so that 'once the wage is given, the rate of profits is determined for both systems regardless of the proportions of the equations in either of them'.[28] Thus, Sraffa concludes, the rate of profits *over the economy as a whole* is determined as soon as we know R (the ratio of net product to means of production in the 'standard' industry, which is equal to the 'maximum rate of profits'), and w (the proportion of the net product of the 'standard' industry going to wages). Or, to put the point in another way, when the proportion of the net product of the 'standard' industry going to wages is given, the average rate of profits over the economy as a whole depends upon the level of R.

In the remainder of his book, Sraffa makes extensive use of this simple relation between wages and profits to elucidate a number of difficult theoretical problems. In one chapter, for example, he analyses the case where commodities are produced with means of production which were themselves produced at different periods in the past (and so on down the line), so that the profit element in the prices of these means of production is different, and asks how the relative values of the commodities will vary with changes in the rate of profits.[29] In the second part of his book, again, he deals with the new problems which arise when we take account of the fact of the existence of items of fixed capital which outlast one use and gradually depreciate in value during the course of their life. What generalisations can be made, he asks, on the basis of the theoretical foundations erected in the earlier part of the book, concerning the path followed by this depreciation? Finally, carrying on with the method of successive approximations in much the same way as his classical predecessors, he brings land into the picture, and erects a more complex system of equations in which, if wages are given, the prices of all commodities, the rate of profits, *and* the rents payable on different qualities of land, are all determined. To the historian of economic thought, one of the most interesting features of these extensions of the basic analysis is the number of old friends who are met with. For example, in the chapter on fixed capital Sraffa makes interesting use of the old classical device, first used by Torrens, of treating what is left of fixed

[28] Sraffa, p. 23.

[29] In this chapter, Sraffa deals with the problem of reducing 'constant capital' (to use Marx's terminology) to quantities of labour. He points out, in effect, that the reduction operation can in fact be performed, provided that the labour is *dated* labour, since the dating will affect the rate of profits and therefore the prices of the commodities concerned.

capital at the end of the year as a kind of joint product of the industry in which it is used. Of special importance in these later parts of the book are the distinction which is early established between 'basic' and 'non-basic' products,[30] and the general analysis of joint products.

IV

One very important feature of Sraffa's analysis remains to be commented upon—his implied rehabilitation of the classical labour theory of value in something very like the form which it assumed in the hands of Marx. The Marxian labour theory of value does *not* say, as is vulgarly supposed, that the equilibrium prices of commodities are always proportionate to the quantities of labour required to produce them. It affirms, certainly, that this statement is true of an economy where 'the whole produce of labour belongs to the labourer'; but it agrees—indeed emphasises—that equilibrium prices do *not* normally follow this simple rule in a capitalist economy where part of the net product goes to profits. In a capitalist economy, it is demonstrated, relative prices normally deviate from relative quantities of embodied labour, for reasons which have been described earlier in the present article. Even in a capitalist economy, however, it is argued, the equilibrium prices of commodities can still be shown to be 'indirectly' and 'ultimately' determined by certain crucial ratios of quantities of embodied labour applicable to the economy as a whole. For the deviations of price ratios from embodied labour ratios, given the proportions in which labour and means of production are combined together in each industry, depend upon the level of the average rate of profits; and the level of the average rate of profits, it is claimed, depends in its turn upon the crucial ratios of quantities of embodied labour to which I have just referred. Thus if it can in fact be shown that the average rate of profits is determined by these

[30] A 'basic' product, roughly speaking, is one which enters (no matter whether directly or indirectly) into the production of *all* commodities, and a 'non-basic' product is one which does not. A 'luxury' product, for example, which is not used (whether as an instrument of production or as an article of subsistence) in the production of other products, is 'non-basic'. (See Sraffa, pp. 7-8.) The important feature of 'non-basic' products is that they 'have no part in the determination of the system', their rôle being 'purely passive'. In other words, 'the price of a non-basic product depends on the prices of its means of production, but these do not depend on it', whereas 'in the case of a basic product the prices of its means of production depend on its own price no less than the latter depends on them' (p. 9). Specialists in Marxist theory will note the relevance of this part of Sraffa's analysis to an important question which arose in the course of the debate on the so-called 'transformation problem'—the question (raised in particular by Bortkiewicz) as to whether the conditions of production of luxury goods enter into the determination of the rate of profits.

embodied labour ratios, we can reasonably conclude that the very deviations of equilibrium price ratios from embodied labour ratios are themselves determined by ' quantities of embodied labour '.

Marx's method of showing the dependence of the rate of profits on ' quantities of embodied labour ' in this sense can be illustrated with the aid of the following simple model:

	Means of Production	*Wages*	*Surplus Value*
A.	40	160	80
B.	60	90	45
C.	120	80	40

We here assume that the economy consists of three separate industries, A, B and C. The quantities under the three headings ' Means of Production ', ' Wages ' and ' Surplus Value ' are each reckoned in terms of hours of labour. Take industry A as an example. In industry A, the means of production used up during a given period of production are assumed to ' contain ' or ' embody ' a total of 40 hours of past labour. The total amount of present or direct labour expended in the industry during the period is assumed to be 240 hours—the sum of the figures 160 and 80 under the respective headings ' Wages ' and ' Surplus Value '. It is assumed that in two-thirds of this total working time—i.e., 160 hours—the direct labourers are able to contribute just enough value to the product to cover their own wages. In the remaining 80 hours they contribute what Marx called ' surplus value ', which he assumed to be the sole source of capitalist profit. The same interpretation is given to the figures for industries B and C, where, it will be noticed, the proportions in which labour and means of production are combined together are different from those in industry A. The ratio of surplus value to wages is assumed to be the same (in this case 1 : 2) in each industry.

The average rate of profits in this economy, Marx argued, can be found by taking the aggregate surplus value yielded over the economy as a whole (165) and redividing it among the three industries in proportion to the means of production employed in each. Or, to put the point in a way which is perhaps easier to understand, the average rate of profits will be determined by the ratio of aggregate surplus value to aggregate means of production. In this case it will clearly be three-quarters, or 75 per cent.[31] This ratio of aggregate

[31] Marx, in common with his classical predecessors, generally assumed that wages were ' advanced ' out of capital. This meant that in working out the rate of profits he normally related surplus value to means of production

quantities of embodied labour, then, determines the average rate of profits, and thus the deviations of equilibrium price ratios from embodied labour ratios.

At first sight this analysis might seem to have little in common with Sraffa's. But suppose we go on to postulate, as Marx himself did, an industry in which the ratio of used-up means of production to wages is equal to the ratio of these quantities when they are aggregated over the economy as a whole. Industry B in our illustration is clearly an industry possessing this characteristic—it is an industry in which, to use Marx's terminology, the 'organic composition of capital' is equal to the 'social average'.[32] In such an industry, as can be seen from the illustration, the ratio of surplus value to means of production (45 : 60) is equal to the ratio of these quantities over the economy as a whole (165 : 220). We can thus say, as Marx did,[33] that the average rate of profits over the economy as a whole is determined by the ratio of surplus value to means of production *in this industry B*, whose conditions of production represent a sort of 'social average'. Or, to put the same proposition in another way, the average rate of profits over the economy as a whole is given by the following expression:[34]

$$\frac{\text{Labour embodied in net product of industry B}}{\text{Labour embodied in its means of production}}\left(1-\begin{array}{l}\text{proportion of}\\\text{net product of}\\\text{industry B going}\\\text{to wages}\end{array}\right)$$

Now, the similarity between this Marxian relation and that expressed in Sraffa's $r = R(1-w)$ is surely very striking. For, in the first place, let us note that Sraffa's R, although usually expressed as the ratio of the *value* of the net product of the 'standard' industry to the *value* of its means of production, is in fact equal to the ratio of the *labour embodied* in the net product of the 'standard' industry

plus wages. Following Sraffa's precedent (p. 10), I am assuming here that the wage is not in fact 'advanced', but 'paid *post factum* as a share of the annual product', which means that the rate of profits is obtained by relating surplus value to means of production alone. To drop this particular assumption of Marx's does not affect the essence of his analysis, and greatly facilitates the comparison with Sraffa which is made below.

[32] See *Capital*, Vol. III (Kerr edn.), p. 193. In the example, the 'organic composition of capital' in industry B (60 : 90) is clearly equal to the 'organic composition of capital' over the economy as a whole (220 : 330).

[33] *Capital*, Vol. III, p. 204.

[34] In this expression the 'net product' is taken to consist of wages plus surplus value (as, in effect, it is with Sraffa). Thus the expression is merely another way of formulating the ratio of surplus value to means of production, each of these quantities being estimated in terms of embodied labour.

to the *labour embodied* in its means of production.[35] In other words, Sraffa is postulating precisely the same relation between the average rate of profits *and the conditions of production in his 'standard' industry* as Marx was postulating between the average rate of profits *and the conditions of production in his industry of 'average organic composition of capital'*. What both economists are trying to show, in effect, is that (when wages are given) the average rate of profits, and therefore the deviations of price ratios from embodied labour ratios, are governed by the ratio of direct to indirect labour in the industry whose conditions of production represent a sort of 'average' of those prevailing over the economy as a whole. Marx reached this result by postulating as his 'average' industry one whose 'organic composition of capital' was equal to the 'social average'. But his result could only be a provisional and approximate one, since in reaching it he had abstracted from the effect which a change in the wage would have on the prices of the means of production employed in the 'average' industry.[36] Sraffa shows that the same result can be achieved, without abstracting from this effect at all, if we substitute his 'standard' industry for Marx's industry of 'average organic composition of capital'. Sraffa's 'standard' industry, seen from this point of view, is essentially an attempt to *define* 'average conditions of production' in such a way as to achieve the identical result for which Marx was seeking.

RONALD L. MEEK

University of Glasgow

[35] Cf. Sraffa, pp. 16-17. The reason for the equivalence of the value ratio and the embodied labour ratio is as follows: When profits are zero, the prices of all commodities are proportionate to the quantities of labour required to produce them (as has been shown above, pp. 125-6). And when profits rise *above* zero, the ratio R by hypothesis does not change. Thus whatever the level of profits the value ratio remains equal to the embodied labour ratio.

[36] Marx made this abstraction quite deliberately, and was fully aware that his result was therefore provisional and approximate. See *Capital*, Vol. III, pp. 241-3.