

# *political economy* Studies in the Surplus Approach

volume 4, number 2, 1988

- 159 Enrico Levirini, Joint Production:  
Review of Some Studies on Sraffa's System
- 176 Four Questions on Joint Production
- 177 Salvatore Baldone
- 185 Gérard Duménil and Dominique Lévy
- 213 Marco Lippi
- 223 Neri Salvadori and Ian Steedman
- 231 Bertram Schefold
- 243 Paolo Varri
- 251 Pierangelo Garegnani, Actual and Normal Magnitudes: A Comment on Asimakopulos
- 259 Athanasios Asimakopulos, Reply to Garegnani's Comment
- 263 Edward Nell, Does the Rate of Interest Determine the Rate of Profit?
- 269 Larry Randall Wray, The Monetary Explanation of Distribution - A Critique of Pivetti
- 275 Massimo Pivetti, On the Monetary Explanation of Distribution: A Rejoinder to Nell and Wray

## Four Questions concerning Joint Production

Neri Salvadori and Ian Steedman

1. *Do you consider that the joint production framework allows one to treat important issues and problems — other than fixed capital — both theoretically and concretely?*

Without suggesting that any given framework will be sufficient for the treatment of all important issues, one can assert that allowing for joint production is a *necessary* condition for the adequate confrontation of many significant concerns, both theoretical and applied. Not least, to allow fully and openly for joint production is a *necessary* condition for the continued defence and development of a revived “classical” approach to political economy. This is so for, at least, four reasons.

1) Much “mainstream” economic theory takes joint production in its stride: to cite just two famous works, consider Hicks’s *Value and Capital* or Debreu’s *Theory of Value*. Much theory cast in the activity-analysis mould takes it for granted that joint production must (and can) be allowed for and, of course, the von Neumann model, which is so central to much growth theory, does the same. Nor has the position changed in this respect with the more recent use of “dual” formulations; cost function, revenue function and profit function formulations of production theory all allow for joint production. Now, if joint production is in fact of empirical importance — as it is; see 4) below — any revived “classical” approach which seeks to challenge and even to displace the current “mainstream” approaches must, necessarily, demonstrate that it can take joint production issues in its stride just as readily as do those “mainstream” approaches.

2) While much “mainstream” theory permits joint production, as we have just noted, not all of it does and it has been found, indeed, that that can be shown to be a serious weakness. It is known, for example, that (other than in special cases) the presence of joint production prevents a meaningful “reduction to dated labour terms”; which means immediately that all

attempts to construct a “neo-Austrian” approach to economic theory are open to highly damaging criticism.<sup>1</sup> It has also been shown that, in the presence of joint production, a “primary-factor-price-frontier” can be *upward* sloping, even when *no* produced inputs are used and *all* the primary inputs are paid *ex post* (so that there are no interest charges of any kind). This, in turn, undermines both various familiar marginalist comparative statics results — concerning shifts in demand or in factor supplies, or the imposition of tariffs — and some of the theory of Hicksian technical progress.<sup>2</sup> Recognition of joint production, therefore, allows one to extend the “classical” critique of various marginalist theories.

3) Conversely, however, joint production has often been used as the starting point for criticism of the “classical” approach. In Book III, chapter XVI of his *Principles of Political Economy*, J. S. Mill considered some of the effects of joint production and wrote that, in determining the values of jointly produced commodities, “we must revert to a law of value anterior to cost of production, and more fundamental, the law of demand and supply”.<sup>3</sup> He called that chapter, “Of some Peculiar Cases of Value”. Not surprisingly, Jevons seized on this in Chapter V of his *The Theory of Political Economy*. “On some other occasion. I may perhaps more fully point out the fallacy involved in Mill’s idea that he is reverting to *an anterior law of value*, the law of supply and demand, the fact being that in introducing the cost of production principle, he had never quitted the laws of supply and demand at all. The cost of production is only one circumstance which governs supply, and thus indirectly influences values. Again, I shall point out that these cases of joint production, far from being ‘some peculiar cases’, form the general rule, to which it is difficult to point out any clear or important exceptions”.<sup>4</sup> Wicksell too, in the first substantive chapter of his *Lectures on Political Economy* (Volume I), insisted that, “It happens in many cases, even where a commodity is manufactured under competitive conditions, that its costs of production *cannot be separated* or imputed because its production proceeds simultaneously and in combination with that of other goods ... Such cases, which have been given by Marshall the technical name ‘joint supply’, are mentioned also by Mill in his chapter, ‘Some peculiar cases of value’, but, as the chapter heading indicates, Mill regarded them as exceptions to the rule. In reality (as Jevons remarked)

<sup>1</sup> See H. HAGEMANN and H. D. KURZ, “The Return of the Same Truncation Period and Reswitching of Techniques in Neo-Austrian and more General Models”, *Kyklos*, vol. 29, 1976, pp. 678-708.

<sup>2</sup> I. STEEDMAN, “Joint Production and the Wage-Rent Frontier”, *Economic Journal*, vol. 92, 1982, pp. 377-385 and “Joint Production and Technical Progress”, this Journal, vol. 1, 1985, pp. 41-52.

<sup>3</sup> J. S. MILL, *Principles of Political Economy* [1848], London, Routledge and Sons, 1891, p. 387.

<sup>4</sup> W. S. JEVONS, *The Theory of Political Economy* [1871], Harmondsworth, Penguin Books, 1970, p. 209.

they occupy a large, perhaps the largest, part of the field of production".<sup>5</sup> Nor has this form of criticism of "classical" theory been forgotten, for F. H. Hahn has more recently apparently referred to joint production as being a difficulty for "neo-Ricardian" theory.<sup>6</sup>

It follows, then, that if the revived "classical" approach is to be able to defend itself successfully against criticism, a *necessary condition* of such success is that that approach must demonstrate its capacity for dealing with joint production issues.

4) Had Jevons and Wicksell been wrong about the empirical importance of joint production, it would perhaps have been possible to maintain that a single-products theory was perfectly adequate to deal with most genuine and important economic questions — and that generality is not to be pursued too far for its own sake in a subject such as political economy. But the brute *fact* is that Jevons and Wicksell were not wrong: as soon as one begins to consider productive processes at the level of detail *necessary* for a Sraffa-based analysis of prices and distribution, one finds that joint production is, *empirically, extremely widespread*. There is not the space here to present detailed lists of actual, real world cases of joint production; we can only refer the reader to Steedman (1987)<sup>7</sup> for such lists drawn from the areas of agriculture, fishing, forestry and paper making, mining, petroleum, chemical engineering, metallurgy, mechanical engineering, electricity, textiles, transport, communications, construction and others. And as is also discussed in that same paper, there *could not be* such issues and problems as (a) pollution, (b) waste disposal and (c) recycling were it not for the factual, real world importance of joint products in many production (and consumption) activities. To insist on the importance of analysing joint production systems, far from being to insist on theoretical generality for the sake of generality, is to insist that the theorist pay serious attention to what real economic processes are like "out there in the real world".

In brief, *not* to adopt a joint production framework in the context of "classical" theory is to weaken one's criticism of marginalist theory, to leave oneself exposed to damaging criticism *from* marginalist theory, and simply to shut one's eyes to *major* real world phenomena. For any proponent of modern "classical" theory to dismiss joint production would be to behave like the proverbial ostrich.

<sup>5</sup> K. WICKSELL, *Lectures on Political Economy* (Volume I) [1901], London, Routledge and Kegan Paul, 1967, p. 26.

<sup>6</sup> F. H. HAHN, "Revival of Political Economy: The Wrong Issues and the Wrong Argument", *Economic Record*, vol. 51, 1975, pp. 360-364, at p. 363.

<sup>7</sup> I. STEEDMAN, "L'importance empirique de la production jointe", in CH. BIDARD (ed.), *La Production Jointe, Nouveaux Débats*, Paris, Economica, 1984, pp. 5-20.

they occupy a large, perhaps the largest, part of the field of production".<sup>5</sup> Nor has this form of criticism of "classical" theory been forgotten, for F. H. Hahn has more recently apparently referred to joint production as being a difficulty for "neo-Ricardian" theory.<sup>6</sup>

It follows, then, that if the revived "classical" approach is to be able to defend itself successfully against criticism, a *necessary condition* of such success is that that approach must demonstrate its capacity for dealing with joint production issues.

4) Had Jevons and Wicksell been wrong about the empirical importance of joint production, it would perhaps have been possible to maintain that a single-products theory was perfectly adequate to deal with most genuine and important economic questions — and that generality is not to be pursued too far for its own sake in a subject such as political economy. But the brute *fact* is that Jevons and Wicksell were not wrong: as soon as one begins to consider productive processes at the level of detail *necessary* for a Sraffa-based analysis of prices and distribution, one finds that joint production is, *empirically, extremely widespread*. There is not the space here to present detailed lists of actual, real world cases of joint production; we can only refer the reader to Steedman (1987)<sup>7</sup> for such lists drawn from the areas of agriculture, fishing, forestry and paper making, mining, petroleum, chemical engineering, metallurgy, mechanical engineering, electricity, textiles, transport, communications, construction and others. And as is also discussed in that same paper, there *could not be* such issues and problems as (a) pollution, (b) waste disposal and (c) recycling were it not for the factual, real world importance of joint products in many production (and consumption) activities. To insist on the importance of analysing joint production systems, far from being to insist on theoretical generality for the sake of generality, is to insist that the theorist pay serious attention to what real economic processes are like "out there in the real world".

In brief, *not* to adopt a joint production framework in the context of "classical" theory is to weaken one's criticism *of* marginalist theory, to leave oneself exposed to damaging criticism *from* marginalist theory, and simply to shut one's eyes to *major* real world phenomena. For any proponent of modern "classical" theory to dismiss joint production would be to behave like the proverbial ostrich.

<sup>5</sup> K. WICKSELL, *Lectures on Political Economy* (Volume I) [1901], London, Routledge and Kegan Paul, 1967, p. 26.

<sup>6</sup> F. H. HAHN, "Revival of Political Economy: The Wrong Issues and the Wrong Argument", *Economic Record*, vol. 51, 1975, pp. 360-364, at p. 363.

<sup>7</sup> I. STEEDMAN, "L'importance empirique de la production jointe", in CH. BIDARD (ed.), *La Production Jointe, Nouveaux Débats*, Paris, Economica, 1984, pp. 5-20.

2. *What is the significance of those results from research on joint production systems which appear to be incompatible with single products results?*

The results which are valid for single production but which do not hold in general joint production models are the following:

- (1) all products are separately producible and, as a consequence, a system of production is always square and labour values are always positive;
- (2) a basic commodity can be defined as a commodity which enters directly or indirectly into the production of all the commodities in the system of production; the distinction between basics and non-basics is important since basics have a number of properties which are not shared with non-basics;
- (3) the Standard commodity exists and consists of positive amounts of basics only;
- (4) the profit rate reaches a finite and unique maximum,  $R$ , when the wage rate equals zero and the corresponding prices of basic commodities are positive;
- (5)  $R$  is the lowest positive real number such that the price equations are satisfied with a zero wage rate;
- (6) if the profit rate is between zero and  $R$  the prices of basic commodities in general vary as it varies but remain positive and finite;
- (7) the relationship between the wage rate and the profit rate is decreasing irrespective of the numeraire chosen;
- (8) prices in terms of the wage rate are increasing and convex functions of the profit rate for each system of production;
- (9) a cost-minimizing system of production is proved to be any system which can pay the higher wage rate (profit rate) for a given profit rate (wage rate) and it is determined independently of the requirements for use;
- (10) all prices in a cost-minimizing system are positive if there exists a system with prices all positive at the given profit rate (wage rate).

The fact that these results do not always hold if joint production is allowed should push us first of all to investigate the hypotheses and the assumptions stated. It is quite natural to assume that a single production system is square. Why should a joint production system be so? Why should it be useful to assume that it is so? The concepts of basic commodity<sup>8</sup> and

<sup>8</sup> The distinction between basics and non-basics does not seem to be important in joint production systems since the only properties which basics have and are not shared with non-

Standard commodity<sup>9</sup> are very useful concepts to analyse single product systems. Why should such concepts be useful to analyse joint production systems?

Sraffa's own assumption asserting that each system contains exactly as many processes as commodities is questionable. Despite the fact that several authors<sup>10</sup> have shown that, if some conditions are met, such an equality can actually be proved, in the general case there is no way to justify the assumption of a number of processes equal to the number of commodities.<sup>11</sup> Moreover, it has been shown<sup>12</sup> that if a "system" contains, by definition, a number of processes equal to the number of commodities, then such an assumption may rule out the existence of "cost-minimizing systems", or may introduce the possibility that the unique cost-minimizing system is associated with a price vector containing a negative price despite the fact that a system with positive prices exists. This has led to the consideration of both *square* and *non-square* systems. Simple changes in the definition of a system of production and of a cost-minimizing system are able to eliminate these difficulties but "requirements for use"<sup>13</sup> are to be introduced

basics are the following: (1) all basics and none of the non basics enter the Standard commodity; (2) if the price of a basic is changed, all prices are affected, whereas if the price of a non basic is changed because of a specific tax on it, not all prices are affected, and, specifically, those of basics are not.

<sup>9</sup> In the first part of his book, Sraffa uses the Standard commodity to simplify the analysis of the mathematical properties of prices of production. More specifically, he uses it to show that statements (4)-(7) hold. Since these statements do not hold in general joint production systems, the investigation of the Standard commodity in such systems does not seem to be very useful.

<sup>10</sup> I. STEEDMAN, "Positive Profits with Negative Surplus Value: a Reply to Wolfstetter", *Economic Journal*, vol. 86, 1976, pp. 873-876; B. SCHEFOLD, "On Counting Equations", *Zeitschrift für Nationalökonomie*, vol. 38, 1978, pp. 253-285; B. SCHEFOLD, "Von Neumann and Sraffa: Mathematical Equivalence and Conceptual Difference", *Economic Journal*, vol. 90, 1980, pp. 140-156; B. SCHEFOLD, "The Dominant Technique in Joint Production Systems", *Cambridge Journal of Economics*, vol. 12, 1988, pp. 97-124; N. SALVADORI, "Fixed Capital within the Sraffa Framework", *Zeitschrift für Nationalökonomie*, vol. 48, 1988, pp. 1-17.

<sup>11</sup> Let us consider an economy where there is only one process,  $(a, b, l)$ ;  $a^T = (1, 1)$ ,  $b^T = (3, 3)$ ,  $l = 1$ ; the growth rate equals zero, the profit rate equals 1; capitalists consume only commodity 2 and workers consume only commodity 1. Then  $p_1 = p_2$ ,  $w = 2p_1$ , and no commodity is overproduced. See also R. FRANKE, "On the Upper- and Lower-Bound of Workers' Propensity to Save in a Two-Class Pasinetti Economy", *Australian Economic Papers*, vol. 25, 1985, pp. 271-277, at p. 274.

<sup>12</sup> CH. BIDARD, "Choix Techniques en Production Jointe", in CH. BIDARD (ed.), *La Production Jointe, Nouveaux Débats*, Paris, Economica, 1984, pp. 186-207; G. DUMENIL and D. LEVY, "The Unifying Formalism of Domination: Value, Price, Distribution and Growth in Joint Production", *Zeitschrift für Nationalökonomie*, vol. 44, 1984, pp. 349-371; D. LEVY, 1984, "Le Formalisme Unificateur du Surclassement: Valeur, Prix, Répartition et Croissance en Production Jointe", in CH. BIDARD (ed.), *La Production Jointe, Nouveaux Débats*, Paris, Economica, 1984, pp. 37-51; N. SALVADORI, "Mutamento dei metodi di produzione e produzione congiunta. Un commento al § 96 di *Produzione di Merci a mezzo di Merci*", *Studi Economici*, vol. 34, 1979, pp. 79-94; N. SALVADORI, "Existence of Cost-Minimizing Systems within the Sraffa Framework", *Zeitschrift für Nationalökonomie*, vol. 42, 1982, pp. 281-298; N. SALVADORI, "Switching in Methods of Production and Joint Production", *The Manchester School*, 1985, vol. 53, pp. 156-178.

<sup>13</sup> The phrase "requirements for use" is introduced by Sraffa. Despite the fact that it is not a standard term in economic analysis, Sraffa provides no explication of this phrase. Thus

into the above mentioned definitions.<sup>14</sup> Why not accept this fact and try to find a classical way to determine the requirements for use? Of course, other alternative changes in the adopted definitions are possible: a discussion on the possible changes in definitions, hypotheses and assumptions would, we think, be very welcome.

3. *What then is the relation of the joint production framework to that of single products?*

Consider any single-products system, of  $n$  productive processes and  $n$  products, the quantities of produced inputs being displayed in an input matrix and the quantities of products being displayed on the leading diagonal of an output matrix. Holding constant both the input and output quantities just referred to *and* the quantities of all non-produced inputs, we can (hypothetically) obtain infinitely many alternative square joint production systems by inserting various positive output quantities into the off-diagonal elements of the output matrix. In this sense, any single-products system is a special case of infinitely many different, square, joint production systems. And — still in that same sense — it follows that single-product systems have all the properties of square joint production systems but that the converse cannot be expected to (and does not) hold good. Two points may be noted here. The first is that even a *minimal amount* of joint production can change the *qualitative* properties of the system. Thus, starting from a single-products system as above, add *just one* positive output to some off-diagonal element of the output matrix. We now have, of course, an  $n$  process economy in which  $(n - 1)$  processes produce only a single product, while the remaining process produces just two products; one could hardly think of a joint production system which is more similar to a single-products one. Yet it can be shown that, in such a system, labour-commanded prices need not all be monotonically increasing with respect to the uniform rate of profit.<sup>15</sup> The second point to be noted is that not every square joint production system can be represented as being equivalent to some single-products system *plus* some added off-diagonal positive outputs. Thus suppose that there are three processes and products. The first two processes each produce *only* product 1 (while using produced inputs in different proportions) and the third process produces products 2 and 3. It is not

one is obliged to be cautious in offering an interpretation. Nevertheless it might seem that Sraffa was seeking to de-emphasize the subjective elements in the determination of the pattern of output, without denying them.

<sup>14</sup> N. SALVADORI, "Switching in Methods of Production and Joint Production", *The Manchester School*, 1985, vol. 53, pp. 156-178.

<sup>15</sup> N. SALVADORI and I. STEEDMAN, "Joint Production Analysis in a Sraffian Framework", *Bulletin of Economic Research*, vol. 40, 1988, pp. 165-195, at pp. 181-182.



possible so to reorder the processes and products that the output matrix has a strictly positive diagonal.

Even square joint production systems are, then, far more general than single-products systems and the former do not share all of the properties of the latter. Since, as was explained in response to the first question, it is imperative that joint production be allowed for, it follows that one should *not* lay great stress on those results derived from single-products theory which are not also valid in a joint production context. Although the careful study of single production can, of course, be a most useful *preliminary* to the study of joint production, one is forced to conclude that, fundamentally, the relation of the joint production framework to that of single-products is simply that the former should *supersede and completely replace* the latter.

4. *What do you consider to be the most important open questions and, more generally, what is your assessment of the current state of the debate in the field of joint production?*

In recent years the debate has shifted quite a lot from the initial problems and several "Sraffians" are investigating joint production models which, we think, can well be in the spirit of part two of Sraffa's book but do not follow it literally.<sup>16</sup> On the other hand the problem of square systems is still open<sup>17</sup> and an open, frank, and clear discussion on this would be very appropriate at this stage. However, it seems that other results in the theory of joint production can be obtained only after the problem of the determination of outputs, which includes the problem of demand (or "requirements for use") and of its rôle within the classical theory of production and distribution, has been solved.

*Istituto di Scienze Economiche, Istituto Universitario Navale, Napoli,  
Department of Economics, University of Manchester*

<sup>16</sup> See CH. BIDARD and R. FRANKE, "On the Existence of Long-Term Equilibria in the Two-Class Pasinetti-Morishima Model", *Ricerche Economiche*, vol. 41, 1987, pp. 3-21; R. FRANKE, "Some Problems Concerning the Notion of Cost-Minimizing Systems in the Framework of Joint Production", *The Manchester School*, vol. 52, 1986, pp. 298-307; R. FRANKE, "An Extension of the Gale-Nikaido-Debreu Lemma with Applications to Generalized von Neumann Models", mimeo, 1986, University of Bremen; D. K. FOLEY, "On Prices of Production in a General Model of Production", *Contributions to Political Economy*, vol. 4, 1985, pp. 25-36; N. SALVADORI, "Fixed Capital within the Sraffa Framework", *Zeitschrift für Nationalökonomie*, vol. 48, 1988, pp. 1-17.

<sup>17</sup> See, for example, B. SCHEFOLD, "The Dominant Technique in Joint Production Systems", *Cambridge Journal of Economics*, vol. 12, 1988, pp. 97-124.