

On the “Photograph” Interpretation of Piero Sraffa’s Production Equations

A View from the Sraffa Archive

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1. Introduction

Alessandro Roncaglia in his book *Sraffa e la teoria dei prezzi* (1975), an English version of which was published as *Sraffa and the Theory of Prices* (1978), put forward the view that Sraffa’s systems of price equations are best interpreted in terms of a “photograph” taken of the economic system at a given moment of time or, rather, a snapshot of a cycle of production of the system. He wrote:

The determination of prices was studied at a given moment of time, given the prevailing technology. ... In other words, the classical economists’ analysis of prices examined the situation of a given economic system at a given moment in time, much like a photograph of the system at an instant in time.

He added:

In this way all the economic variables which were not the object of analysis could be considered as given. Theoretical investigation could concentrate attention on the “virtual” movement of specific variables and on the relations between these variables as if they were being considered “isolated in a vacuum”. In the case of *Production of Commodities by Means of Commodities* the choice of variables to be analysed has fallen

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on the relations that exist between prices of production and the distributive variables, the wage rate and the rate of profits. (Roncaglia 1978: 21)¹

This short contribution revolves around the metaphor of “photograph” and its possible meaning(s) in Sraffa’s preparatory papers leading up to his 1960 book and the book itself. We proceed in the following way. We ask, first, whether, and if so, when Sraffa came across the metaphor in the literature and used it himself (Section 2). Next we draw the attention to another, but closely related metaphor Sraffa used – “the man from the moon”, and its possible relation to Ricardo’s activities in parliament (Section 3). Then we discuss a statement by Maffeo Pantaleoni in one of his books that Sraffa annotated; his annotation throw some light on the materialist or objectivist approach Sraffa was keen to develop in the late 1920s and at the beginning of the 1930s (Section 4). Then we reflect upon the relationship between Sraffa’s analysis in his 1960 book and what he called “the standpoint ... of the old classical economists from Adam Smith to Ricardo” (Sraffa 1960: v) in the theory of value and distribution (Section 5). The metaphor of the photograph reappears in Sraffa’s correspondence with a German student in 1968 and its meaning there is precisely the one implied by Sraffa’s characterisation of the classical as opposed to the marginalist approach in the theory of value and distribution; the way Roncaglia uses it is similar (Section 6). The paper concludes with a few final observations (Section 7).

2. Sraffa and the metaphor of “photograph”

In Sraffa’s hitherto unpublished manuscripts and notes and in his annotations in books and papers, kept at Trinity College Library, Cambridge, the term “photograph” appears a couple of times in different contexts. We do not know whether Roncaglia came across the term when he and John Eatwell took stock of Sraffa’s papers in the 1970s, before Sraffa appointed Pierangelo Garegnani as his literary executor, who with the help of Krishna Bharadwaj

¹ Roncaglia reiterated these statements in Roncaglia (2009).

produced the first catalogue of Sraffa's papers.² Here we provide at first a reference to the term "photograph" in a book by Cunyngame Sraffa had read and annotated. Next we turn to his preparatory notes for his 1960 book, which he began to compose as early as November 1927, but had to interrupt beginning in 1930 because of his appointment to the editorship of Ricardo's works and correspondence by the Royal Economic Society. He resumed the work on what he called "my book" in 1942, but had to interrupt it once more after the discovery of Ricardo's correspondence with James Mill, and finally was able to put together the book from his old notes from 1955 to 1958. Finally we will consider the use of the metaphor in Sraffa's correspondence.

(a) An annotation in one of Sraffa's books

The term "photograph" is probably first mentioned in the context of Sraffa's critical scrutiny of marginalist or demand and supply theory, with the focus on market equilibrium. In 1904 Henry Cunyngame had published *A Geometrical Political Economy, Being an Elementary Treatise on the Method of Explaining Some of the Theories of Pure Economic Science by Means of Diagrams*. The book is in Sraffa's library (item 2243) and is annotated by him. There is reason to presume that Sraffa read it at an early time. In his treatise Cunyngame stresses right at the beginning:

All the curves mentioned in this book are intended to be applicable to *states of equilibrium*, reached after temporary oscillations have ceased; or rather, since all things are in a state of perpetual flux, as *instantaneous photographs* taken at times *when the market conditions are normal*. (Cunyngame 1904: 3; second emphasis added)

In the margin of this passage Sraffa put a straight line. By straight lines he typically signalled the relevance of a passage from the point of view of his own studies at the time or approval of the proposition contained in it. The important thing to note here is that the photograph under consideration has been taken at the right moment, that is, when the economic system is in a "state of equilibrium" or, somewhat less stringent, when "market conditions are normal". As

² The catalogue now typically used is the one elaborated by Jonathan Smith, archivist of Trinity College Library; see <http://www.trin.cam.ac.uk/SRAFFA>. In the following all references to Sraffa's papers are to it.

anyone who has ever used a camera to catch a moment or a particular situation knows, the art consists in pushing the trigger button at the “right moment”. Missing it gives a picture that does not catch in full what the photographer was interested in seeing and in the extreme nothing of interest at all. Obviously, “hitting the moment” presupposes that the photographer already has an idea of the object to be caught and seeks to catch it when it materializes. Cunyngame’s wording makes it very clear that the trigger button of the camera must not be pressed arbitrarily, that is, at any time, but precisely when equilibrium or normal market conditions obtain. Since they will hardly ever be realised in actual fact, it should also be clear that the photograph cannot be taken to capture the realised state of markets in an actual economy, but refers to an idealised state, one that is hypothetically in equilibrium or exhibits normal market conditions. In Marshallian partial equilibrium theory, the point of reference is the intersection between a demand and a supply function, as Cunyngame stresses. The photograph thus conveys the image the photographer has in his mind of a very particular situation in the market. It does not portray reality as it is, but as the photographer thinks it is, focusing attention on the magnitudes in terms of which certain phenomena (relative prices and income distribution) can be explained.

Cunyngame then asks whether there is a difference between a Marshallian short and a long-period analysis and opines: “It does not seem to me, nor do I understand Professor Marshall to say (see *Principles of Economics*, Book v, ch. iv, p. 416, 1890 ed.), that there is any fundamental difference between short-period and long-period curves.” (1904: 3) Interestingly, there is also a straight line along this passage in Sraffa’s copy of the book. What did Sraffa wish to express by annotating the passage in this way at the time when he annotated it? We cannot know for sure, but will put forward some considerations that might perhaps contain a clue to grasping what he probably had in mind. However, we will postpone this discussion and first turn to documents from Sraffa’s unpublished papers.

(b) Sraffa’s unpublished papers

(i) In a manuscript of several pages entitled “Difference vs. Change”, contained in a folder with the title “After 1927”, which can safely be assumed to have been written in the first period of his constructive work (1927-1930), Sraffa made an attempt to clear up what he considered to be a fundamental confusion in the theory of value. Immediately below the

document's title he added: "(simultaneous) (succession in time)", the former bracketed term obviously relating to "Difference" and the latter to "Change". He wrote:

The general confusion in all theories of value (except Marx probably) must be explained by the failure to distinguish between two entirely distinct types of questions and the universal attempt of solving them both by one single theory.

The two questions are:

- 1) What determines the [*difference* in the?] values at which various commodities are exchanged in a given market on a given instant?
- 2) What determines the *changes* in the values of commodities at different times? (e.g. of *one* commodity) (D3/12/7: 115; Sraffa's underlinings are italicized here)³

Sraffa, after some deliberation, concluded: "The first problem gives rise to a geometrical theory, the second to a mechanical one." (117) With regard to the first problem/theory he adds that "Its object is, as it were, the *photograph* of a market place" and that it "must be solved by the theory of value. The second, I think, can only be solved by the theory of industrial fluctuations. – All the old confusion between cause and measure of value is connected with the mixing up of the two questions" (117; emphasis added). Against the background of this distinction he then argued that Marshall's theory "can only be understood as an attempt to solve the first question in terms of the second" (117). What about Marx's theory? Sraffa observed that Marx wanted to tackle both problems in terms of a single theory by focusing attention on what is common to all commodities. Marx asked, first, if today coal exchanges for boots at a given ratio, "what is the common element, the substance which enters in equal quantity in the two things, hidden behind the widely different appearances?" He asked, secondly, if a year ago the exchange rate was different: "what is the difference, hidden behind the identical appearance of these two pairs of boots, which makes them different in exchange?" Sraffa then added: "this way of putting the distinction is confusing. If the

³ He inserted a note written in all probability in the same period, which reads:
"Perhaps the two questions are better enunciated thus:

- 1) differences in value of two commodities at one time
- 2) changes in value of one commodity at two times (value in terms of commodities in general: whence Ricardo's troubles for finding an "unchanging measure of value", which in the first question is not involved.)"

‘common substance’ is drawn in for the first case, it is clear that as it explains the equality in the first case, it will explain the difference in the second. Besides the making of the first a matter of equality and of the second a matter of difference, is a purely verbal trick ...” (118)

What to make of this? First, the metaphor of photograph is again invoked with regard to markets and the relative prices solving the corresponding equations. The theory has to capture the constellation of forces responsible for the observed prices and the picture shot is supposed to expose them. As regards the search for a “common substance”, Marx’s (in)famous *tertium comparationes*, the question is, of course, what it is and what its properties are, whether it is unique, and whether it can be known independently of solving the equations of production, whether it remains the same when time goes by, and so on. As regards intertemporal (and also interspatial) comparisons there seems to be no presumption that there is a common substance “embodied” in commodities produced at different times, the “substance”, if any, is rather bound to change over time.

In this document the metaphor of a photograph appears to be invoked as an alternative to that of a motion picture: a single photograph can highlight elements one might easily lose sight of when confronted with a quick sequence of snapshots as in a film, but the dynamical aspects can, at least partially, be lost.

(ii) In a note entitled “Working capital”, stemming from November 1927, Sraffa reflected upon a lecture by Keynes he had attended, in which Keynes had argued that “Circulating capital is exceedingly small.” After some deliberation Sraffa concluded that “W.[orking] Capital is exceedingly small because it is the photograph of what exists at any one moment, not of what has been spent during the period.” Hence the metaphor of the photograph is misleading in the present context or, rather, it provides only very limited information that can easily be misread. If the whole picture of the social process of production is taken into account, firms turn out to have a huge working capital. Sraffa explains: “Nobody holds stocks. What matters is to have ready command over stocks, to be able to rely with certainty upon possibility of procuring it. But this is *money*. Firms have an enormous working capital because they have money. This *is* capital ...” (D3/12/11: 37)

Sraffa here refers to the distinction between stocks and flows. While a photograph can only depict stocks, even flows may be depicted in that way. Once again the question is asked how

much a single photograph can show or explain compared to a motion picture, but in the present context a photograph is clearly inferior, because it may provide a distorted picture of reality.

(iii) Finally we turn to a manuscript of three pages dated “Oct. 1929”, in which Sraffa discusses anew what a theory of value has to accomplish (D3/12/13: 1 (1-3)). At the time when he wrote it he had already elaborated the method of reduction of prices to dated quantities of labour and felt that the Böhm-Bawerkian concept of “period of production” could be employed as an alternative to his equations. We transcribe the manuscript in full.

Sraffa introduces the issue in the following way:

The real question is:

Given the situation of an / (number of) / industry / (completely integrated vertically) / *at one instant* (i.e. given all physical, chemical, etc. connotations⁴ and measurements of the situation, but excluded all economic connotations, especially values, utilities, productivities, etc.) and assuming all men exactly alike to one another (both for wages they receive, and value they add to the product) is it possible to deduce the value of its product per unit of time?

Or, is the above possible, given the same data for, *not* an instant, but for *a period of time*, such that all the different operations should be performed within it? (more exactly: such a proportion of them that the defect should be smaller than any assigned proportion.) (This would be, roughly, a year in agriculture; but one day, or perhaps one hour in case of continuous shifts, in the motor industry).

He goes on:

As regards labour, the answer is simple enough: so far as it is concerned, value will be proportional to the number of workers employed.

⁴ In the margin he adds: “including wages, or not?”.

It is with capital that difficulties arise: for, while for labour we have defined a measure by assuming all workmen to be equal, we have no such measure for capital: *it is composed of heterogeneous objects*, which cannot be measured, “qua” capital, by number or weight, etc. (D3/12/13: 1(1); here words underlined once are italicized and words underlined twice are underlined once and italicized)

How to deal with this problem?

Suppose the above difficulty is overcome by measuring capital as accumulated labour; i.e. adopting the *second* question [sic! The reference ought to be to equation, meaning the approach in terms of periods of production rather than simultaneous equations], and assuming that all the various acts of labour are performed within a period of production, and that their order of succession is known.

Thus, “time” is part of our assumptions, i.e. they are not instantaneous: but it is a peculiar time, or perhaps only a part of time. It admits only of cyclical change, i.e. it is a sort of circular time: changes take place, but only recurrent changes, which periodically lead back to the original position: no permanent, or “true”, change is allowed.

With these assumptions we can go as far as the second equations [i.e. with a surplus], and also introduce rent (to some extent: but we must assume knowledge of wages (*or* of rate of interest). To dispense with the last knowledge, we must pass to the “marginal” analysis: and this involves knowledge (and possibility) of possible changes – different from anything that actually occurs, in the course of the “steady process”. How can this difficulty be overcome?

Sraffa continues:

Clearly, we must reduce *all* the data to things that actually happen, excluding inexistent possibilities. Only such things are measurable, and can enter the theory as “knowns”, or

“constants”; and, in reality, only really happening things can be real causes and determine effects. (D/12/13: 1(2))⁵

This notion of time is important: it really substitutes “instantaneous photographs” as opposed to ordinary time. It is only a part of ordinary time, it has only some of its connotations: it includes events, / also different events,/ but not change of events. It enables us to compare two simultaneous, but not instantaneous, events – just as if they were “things”.

It is, in effect, equivalent to the physicist’s dt (as understood by Russell (Outline of Phil. [1927], p. 122)⁶ – a time in which effects follow causes, but so closely that there is no room either for dispersion or for entering of foreign influences: dt does this by differentiation (making the time so short as actually to leave no room for change in circumstances: the cause & effect are perfectly contiguous – nothing is in between) – our “time” does this by “assuming” away all changes, (i.e. “coeteris paribus”? no: by positing the problem in the form of finding the conditions of repetition indefinitely, or even once)

This conception of time enables us to take into account, not only *stocks* (as the instantaneous view does) but also steady or cyclical *flows* (which that does not), while still using the geometrical model. (D3/12/13: 1(3))

Once again photograph and movie are contrasted, but now, with reference to a repetitive or self-replacing process, an appropriately redefined concept of the former is considered to capture adequately the case under consideration. The kind of photograph Sraffa speaks of cannot be arbitrary, and, strictly speaking, it cannot be a one-shot snapshot but rather a picture (or sequence of pictures) that contains all the necessary information concerning an entire period of the production of commodities by means of commodities. It conforms to Roncaglia’s snapshot of a cycle of production of the system.

⁵ When Sraffa at the beginning of the 1940s discovered that Bortkiewicz (1906: 970-71) had enunciated essentially the same principle, he henceforth spoke of Bortkiewicz’s “dictum”; see Gehrke and Kurz (2006: 115-18).

3. Another metaphor: the “man from the moon”

Interestingly, Sraffa employed also another metaphor as a shorthand to describe the same thing: the “man from the moon”. The note in which he used it was composed presumably towards the end of the early period of his work, that is, in 1929 or 1930. He characterized his first and second equations (in ink) in the following way:

The significance of the equations is simply this: that if a man fell from the moon on the earth, and noted the amount of things consumed in each factory and the amount produced by each factory during a year, he could deduce at which values the commodities must be sold, if the rate of interest must be uniform and the process of production repeated. In short, the equations show that the conditions of exchange are entirely determined by the conditions of production. (D3/12/7: 87)

This note is interesting for several reasons. First, while it does not refer to a photograph, it contemplates on what an impartial observer, coming from another planet, would see on earth and what he could infer with regard to relative prices and the rate of interest. He would see physical quantities of things (inputs) being transformed into other things (outputs). A photograph would have the task to show these quantities. It would not show the rate of interest and relative prices: These would rather be the result of the impartial observer’s mental work, seeking to find a system of relative prices that support the distribution of the social surplus in terms of a uniform rate of interest across all productive activities. This condition is superimposed on what could be seen in a photograph and reflects particular social institutions or “rules of the game”, such as free competition. From this it follows that the photograph metaphor is of limited use only, because it is unable to capture the essence of the problem at hand: the observer’s projection of given social conditions onto a given physical scheme of production and establishing the implications that follow from them (interest rate, prices).

Second, presumably in 1942 when Sraffa resumed his constructive work and re-read his old notes, he added (in pencil) “Man from the Moon” and also put two straight lines along the

⁶ The reference is obviously to Russell (1927).

passage in the margin. These additions evoke two remarks. First, characterizing the situation under consideration with reference to the man from the moon echoes an event that took place in British Parliament on the occasion of a debate on agricultural distress on 30 May 1820. In the debate Ricardo is reported to have said that “because he consulted the interests of the whole community, he would oppose the corn-laws.” (Ricardo, *Works* V: 49) Henry Brougham, the Member for Winchelsea, who supported the agriculturalists’ motion in favour of additional protective measures, qualified Ricardo’s argument as if it came from a man that “had dropped from another planet” and lived in an “Utopian world” (Ricardo, *Works* V: 56).⁷ The reference to the “man from the moon” may thus be seen as a metaphor designed to indicate the need to take a detached point of view, to see things as they are and not through the tinted glass of some particular interest group. What was badly needed was an objectivist perspective rooted in indubitable facts, such as the productive transformation of things, i.e. commodities, and not a partisan outlook on matters.⁸

Third, and closely related to what has just been said, one has to stay away from existing explanations of income distribution and relative prices and make a fresh start. The man from the moon was by definition in the lucky position of being unaffected by received doctrines (marginalist theory or the labour theory of value) and could seek a new solution to an old problem. This solution, Sraffa implied, the man from the moon could easily find because of his unprejudiced point of view – he is in fact taken to see at a glance what some economists do not see at all and others see only vaguely, namely, that the rate of interest and relative prices follow from the given conditions of production. Economic theory may be a formidable tool that allows us to grasp aspects of a complex subject matter, but it may also mislead or bedazzle us.

⁷ He reiterated this characterization on 7 March 1821; see Ricardo (*Works* V: 85).

⁸ As Sraffa put it in a note written “after 1927” (and probably in 1930, after Sraffa had been appointed to the editorship of Ricardo’s works and correspondence): “we are looking for the objective ground of value, and not for what the producers or their accountants, or the economists regard as sensible” (D3/12/7: 27). This specification of the aim of his investigation is to be found in the context of a critical discussion of the labour theory of value.

The metaphor of the man from the moon can be seen as a development of the metaphor of the photograph. In our interpretation both are steps in Sraffa's search for a non-subjectivist, objectivist explanation of relative prices and income distribution which was at the heart of Sraffa's research programme. We have put forward ample evidence from Sraffa's papers in support of this interpretation and refrain from repeating ourselves here. The interested reader is asked to consult Kurz and Salvadori (2004, 2005), Gehrke and Kurz (2006), Salvadori and Signorino (2007), and Kurz (2012). We rather reflect upon the issues at hand around an annotation in one of Sraffa's book we have not mentioned up until now that provides a welcome foil for our discussion.

4. Interpreting Sraffa's approach vis-à-vis a statement by Pantaleoni

We now turn to Sraffa's annotations in the second edition of Maffeo Pantaleoni's *Principii di economia pura*, published in 1894 (see Sraffa's Library, item 2302), a book he was familiar with and has read at an early time of his career as an economist.⁹ Pantaleoni writes:

La ragione quindi per fermarsi soltanto sulla utilità delle cose come una funzione della loro quantità, e non altresì sulla loro utilità come una funzione dei nostri bisogni, o una funzione delle loro proprietà fisico-chimiche, sta esclusivamente nella *maggior fecondità* di questo concetto. (1894: 99-100; emphasis added)¹⁰

⁹ When Pantaleoni died in 1924, Sraffa published an obituary in *The Economic Journal* signed as P.S. (Sraffa 1924), in which he called him "the prince" of economics in Italy – a characterization with ambivalent meanings, including a reference to the prince in Machiavelli's treatise "Il principe". Pantaleoni had contributed an important essay on the role of power in economics and on the relationship between the strong and the weak (Pantaleoni 1898). He was a towering figure in Italian economics around the turn of the century. A propagator of Marshallian economics in Italy and staunch advocate of markets and competition, he towards the end of his life leaned towards fascism.

¹⁰ English translation: "Therefore the reason to focus attention only on the utility of things as a function of their consumption, and not also on their utility as a function of our

Sraffa puts two straight lines in the margin of this passage, signalling it to be very important. The question is why? We know that from an early time onwards he doubted the alleged “superior fecundity” of marginal utility theory that Pantaleoni extolled. What were the reasons the latter gave in support of it, and could they be sustained in Sraffa’s view?

When singling out marginal utility theory as the best option available to economists, Pantaleoni had to show that alternative approaches to the theory of value and distribution were untenable or at any rate inferior. Sraffa was especially interested to hear what Pantaleoni had to say against attempts to see the values of commodities as rooted in the “physical-chemical properties” of commodities. Why did Pantaleoni think that the values of commodities, that is, “things” (*cose*), could not be explained in this way? Pantaleoni saw such approaches as carrying over John Dalton’s atomic theory straight away to the sphere of economics. However, Pantaleoni was convinced that this was not possible. Dalton’s atomic theory is based on two laws: (i) the Law of the conservation of mass and (ii) the Law of definite proportions or constant composition: in any given chemical compound, the elements are always combined in the same proportion by mass. Are commodities not just embodiments of well-specified amounts of various things, elements or atoms “productively consumed” when produced? The analogy with chemical compounds is indeed close at hand. Water, for example, is both a chemical compound and typically also a commodity and can be represented by $2\text{H}_2\text{O} = 2\text{H}_2 + 2\text{O}$. It is always “produced” in the same way by combining elements H and O in a given composition. If this analogy was to extend to all commodities, then all commodities could be conceived of in terms of the elements constituting them.

Pantaleoni disputed the second of the two laws, the Law of constant composition, because in economics one and the same commodity can typically be produced not only in one way, but in different ways involving different proportions of the physical-chemical elements out of which the commodity is made. This follows from two facts. First, producers are commonly faced with a choice amongst a set of alternative methods of production to produce the same commodity, which is known as the choice of technique problem. Second, even if there would be only a single method available, workers who operate the method could be fed, clothed and housed in different ways, again implying that the object they produce may be conceived as exhibiting, or “embodying”, different physical-chemical compositions.

needs and wants or a function of their physico-chemical properties, rests exclusively with

These observations are obviously correct and must not be ignored. They speak against the possibility of carrying atomic theory over to economics in a straightforward manner, and Sraffa was perfectly aware of this. But did this mean that the physical cost approach to the theory of value and distribution had to be entirely abandoned in favour of marginal utility theory, as Pantaleoni concluded, or could it serve as the starting point of a theory that could be given a coherent form and was possessed of a great fecundity? And what can be said about the coherence, or otherwise, of the marginalist theory of value and distribution? Was it really possessed of a superior fecundity, as Pantaleoni opined?

Here we cannot provide detailed answers to the two questions raised. We ask the reader to consult some works of ours in which we dealt with them in greater detail (see Kurz 2012, 2016, Kurz and Salvadori 2005, Salvadori and Signorino 2007). Here it suffices to point out the following. First, in case Dalton's atomic theory could directly serve as the foundation of the theory of value, the distinction between short and long period would collapse, because natural laws hold at any moment of time and the production of any commodity would always consist in the transformation of well specified amounts of energy and mass into a new form of energy and mass.¹¹ Photographs taken at any instant of time of this process would always show the same picture. This explains perhaps why in the early phase of his constructive work Sraffa vacillated as to the importance of the distinction between long and short period.¹²

the greater fecundity of this concept.“

¹¹ We here ignore that possibility that some fractions of the amounts of inputs will not enter in full the output, but get dissipated into the environment.

¹² This is just another example reflecting Sraffa's vivid interest in whether and what the natural sciences had to offer to the economist who sought to elaborate an objectivist or materialist approach to the problem of value and distribution. If Dalton's atomic theory could be applied in a straightforward manner to economics, which according to Sraffa it cannot, the commodity composition of each and every "thing" would be knowable and fixed and production at any point in time would *always* reflect this composition. A sequence of instants, that is, a period whatever its length, would not give a different picture of chemical compounds. It would always be true, for example, that $2\text{H}_2 + 2\text{O}$ would give $2\text{H}_2\text{O}$. In this case the distinction between short and long run would not add anything to our understanding. However, in economics things are different precisely because an economy that gravitates towards a cost-minimizing long-period position

Second, in November 1927 Sraffa began to elaborate his “first” equations relating to an economic system without a surplus, that is, a system in which no more is produced of the different commodities than is consumed productively (means of sustenance of workers and means of production). In a document entitled “Physical Costs & Value”, contained in a folder “Nov. [1927]”, he noted as regards the values determined in terms of his simultaneous equations:

When I say that the value of a product is “determined” by the *physical volume of commodities used up in its production*, it should *not* be understood that it is determined by the value of those commodities. This would be a vicious circle, because the value of the product is equal to the value of the factors ...

What I say is simply that the numerical proportions between amount of factors and amount of product *is*, by definition, the absolute value of the product. (D3/12/11: 101, first emphasis added, “not” is underlined twice in the original)

And in a document contained in the same folder, he also talked of “physical value” (D3/12/11: 75).

Sraffa also made it clear that the physical cost approach to the theory of value was not his discovery or invention, but was anticipated in earlier works. What he, Sraffa, did was simply to provide a consistent formulation of the approach (followed by its extension to systems with a surplus, without and with fixed capital, joint production proper and scarce natural resources). The physical cost approach, he surmised, was foreshadowed, for example, in the just price doctrine of the canonists, but it essentially derived from the “veduta essenzialmente fisiocratica, che il valore sia una quantità intrinseca degli oggetti, quasi una qualità fisica o

typically changes the way in which commodities are being produced and thus the commodity composition of inputs that enter them. This is so, because in the short period the methods of production actually employed are typically not fully adjusted to the other data of the classical approach to value and distribution (real wages and gross output levels).

chimica”, as he put it in a document composed in the summer of 1929 (D3/12/12: 7).¹³ He was on the lookout of traces of the physical cost approach in the classical authors and encountered many of them. The perhaps most remarkable statement in this regard he came across was contained in the third edition of James Mill’s *Elements of Political Economy*, in which Mill stated: “The agents of production are the commodities themselves ... They are the food of the labourer, the tools and the machines with which he works, and the raw materials which he works upon” (Mill 1826: 165). In summer 1929, Sraffa stated explicitly that he was keen to elaborate an “atomic analysis” (D3/12/13: 16 (9)); and in August 1931, in a critical retrospect, he characterised his previous analytical efforts as having been concerned with developing “an entirely objective point of view”, which is “the natural science point of view” (D3/12/7: 161 (3)).¹⁴

Before we proceed, the following deserves to be stressed. In terms of his first equations Sraffa was able to show convincingly that Pantaleoni’s rejection of an approach based on the physical-chemical properties of things (i.e., commodities) was not well grounded. In the case of the no surplus economy, which is the realm of pure necessity, this approach was the only one capable of explaining “necessary prices”, that is, those prices that allow the self-replacement of the system. The question then was whether the approach could also be successfully carried over to the with-surplus case, and for a while Sraffa appears to have been convinced that it could. This was possible, he thought for a while, by extending the realm of necessity to include it. He felt that this could be accomplished by distinguishing between *natural costs*, on the one hand, and *necessary social costs*, on the other, which implied interpreting the surplus (profits) as a necessary social cost levied upon workers by the capitalist society. Extending the “natural science point of view”, Sraffa insisted, implied that “We shall have to adopt *that definition which makes the scale of absolute values identical with what it was when there was no surplus*” (D3/12/6: 14, emphasis added). In this way the

¹³ English translation of the Italian phrase: „essentially physiocratic point of view that value is a quantity that is intrinsic to the objects, almost a physical or chemical quality.“

¹⁴ In Sraffa (1960: 3) we will eventually read that the values solving the first equations “spring directly from the methods of production”; in his papers he also used the (Ricardian) term “absolute values” with regard to the case under consideration.

logic applying to values in the case of production for subsistence was taken to apply also to the with-surplus case. This necessitated reducing the surplus – i.e. an “effect” for which there had to be “sufficient cause”, as Sraffa wrote in D3/12/7: 161 – to some “cost” or other. Interest, Sraffa at the time insisted, reflects some objective necessity, rooted in some objective “social” as opposed to “natural” obstacles that have to be overcome:

*Interest appears thus as the necessary means of overcoming an obstacle to production. It is a social necessity as distinguished from the material necessity of, say, putting coal into a locomotive that it may do its work. (D3/12/18: 11, emphases added)*¹⁵

If this extension of the natural science point of view was admissible, a purely physical cost of production approach to the theory of value would have been possible. Alas, it was not as Sraffa found out towards the end of the first period of his constructive work. Here we need not dwell on the reasons that prompted Sraffa to abandon the undiluted natural science point of view he at first had endorsed; see therefore Kurz (2012: 1546-1551). It suffices to mention that he saw very clearly that with a choice of technique and flexible consumption patterns of workers the Law of definite proportions could not be carried over to economics and the problem of income distribution could not be reduced to one of necessary cost.¹⁶

5. Production of Commodities by Means of Commodities

We now turn to Sraffa’s 1960 book, the upshot of his earlier efforts. In the book we do not encounter the metaphors “photograph” and “man from the moon”, but it becomes abundantly clear what the equations mean and that they are designed to reformulate in a logically consistent way the approach to the theory of value and distribution of the classical

¹⁵ It deserves mention that this idea was still present when in the summer of 1942 Sraffa, after having read his old notes, resumed his constructive work and jotted down a list of topics (regarding the planned contents of the book he was to write). It contains, among other things: “2) With profits – everything a necessity.” (D3/12/15: 1)

economists. Sraffa in fact states explicitly in the preface of the book that the “standpoint” he takes “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: v). And he also specifies very clearly how in his view the “method” of the classical authors differs from that of the marginalists: In the former “No changes in output and (at any rate in Parts I and II) no changes in the proportions in which different means of production are used by an industry are considered, *so that no question arises as to the variation or constancy of returns.*” He adds: “The investigation is concerned exclusively with such properties of an economic system as do not depend on changes in the scale of production or in the proportions of ‘factors’.” (1960: v; emphasis added). In other words, the classical economists investigated a *given system of production*, that is, they were keen to establish its properties as regards the distribution of income and relative prices. This method, Sraffa maintained was in marked contrast to marginalist method:

The marginalist approach requires attention to be focused on change, for without change either in the scale of an industry or in the ‘proportions of the factors of production’ there can be neither marginal product nor marginal cost. In a system in which, day after day, production continued unchanged in those respects, the marginal product of a factor (or alternatively the marginal cost of a product) would not merely be hard to find – it just would not be there to be found. (Sraffa 1960: v)

This is a warning to his readers: marginal products and marginal costs are analytical objects, not observable ones. In fact, even in a stationary state the observer could calculate the marginal product of a factor or the marginal cost of a commodity, provided that infinitesimal changes *were* (counterfactually) assumed; but obviously no observer can experience them. Things are different with respect to what Wicksteed called “spurious” margins. Sraffa explained: “The most familiar case is that of the product of the ‘marginal land’ in agriculture, when lands of different qualities are cultivated side by side” (Sraffa 1960: v). In this case two different objects are envisaged by the observer and the difference between them defines the

¹⁶ For a discussion of the steps Sraffa took as a consequence of this, see Kurz and Salvadori (2005), Gehrke and Kurz (2006) and Kurz (2012).

increments implicit in the concept of margin. This concept of margin was actually introduced by the Classical economists. Sraffa reminds us that “P.H. Wicksteed, the purist of marginal theory, ... condemns such a use of the term ‘marginal’ as a source of ‘dire confusion’” (Sraffa 1960: v-vi).

The production equations Sraffa then discusses in chapters I and II of the book are actually variants of those he had elaborated in the late 1920s. Sraffa describes technology by listing industries, where each industry is considered as fully described by the list of inputs it employs and the list of outputs it produces. Where do these data come from? Sraffa (1960) is silent about this. However, many remarks from the unpublished manuscripts (among them those mentioned in the above) clarify that these data are supposed to have been directly observed, as it is the case with the man from the moon. As regards the prices he determines for given real wages (conceived as an inventory of commodities) he stressed explicitly that “Such classical terms as ‘necessary price’, ‘natural price’ or ‘price of production’ would meet the case.” (1960: 9) In the with-surplus case these prices involve a uniform rate of profits on the value of the capital goods advanced in each industry of the economy. When Sraffa in Chapter XII of his book discusses the choice of technique problem, he starts from the premise that the choice “will be exclusively grounded on cheapness” (1960: 83). The prices are seen to be the outcome of the cost-minimizing behaviour of producers: “At any given level of the general rate of profits, the method that produces at a lower price is of course the most profitable of the two for a producer who builds a new plant:” (1960: 81)

Finally we draw the attention to Sraffa’s correspondence after the publication of his book. Interestingly the “photograph” metaphor reappears in it once and confirms the meaning we discussed in the above: its purpose is to draw the attention to the classical approach, which is fundamentally different from the marginalist one, and to emphasise its objectivist character revolving around the concept of physical costs and its development.

6. Sraffa’s correspondence

In February 1968 Sraffa received a letter from a German student, Rüdiger Soltwedel, asking him about the meaning and purpose of his equations, which were a riddle to him having been

educated in the marginalist mode of thinking. In Sraffa's reply of 1 March 1968 the metaphor of photograph is used again:

As regards your own interpretation, I must say frankly that you have gone astray the moment you speak of "equilibrium" or of "elasticity of factor supply": all the quantities considered are what can be observed by taking a photograph. There are no rates of change, etc. This point of view was that of the classical economists (e.g. Ricardo), whereas supply & demand curves were introduced in the middle of the 19th century. Economists are now obsessed with them and cannot think without them. My chapter V, which gives you such a headache, could be understood as an attempt to solve a problem set by Ricardo, and which I described in my Introduction (sections IV & V) of Vol. I of the Works of Ricardo, 1951. (C 294: 2)

In this letter the metaphor of the photograph is used precisely in the sense expounded in the preface of Sraffa's 1960 book when specifying the difference between the classical and the marginalist approach to the theory of value and distribution. The classical economists from Smith to Ricardo explained the rate of profits (the real wage rate) and relative prices in terms of a given system of production in use and a given real wage rate (a given rate of profits). The sense also conforms to the one given by Roncaglia: We do have on the one hand a set of given facts (explanans) and on the other a set of magnitudes (wage rate, rate of profits, relative prices) whose relationships are to be determined (explanandum). These relationships define the "mathematical properties" (Sraffa 1960: 23) of the system of production under consideration and thus how a change in one variable (e.g. the wage rate) implies corresponding changes in the other variables (the rate of profits, prices).¹⁷

7. Concluding observations

¹⁷ Interestingly enough, the uniqueness of the Standard commodity is here related only to its role as an invariable measure of value, but this is suggested as a way to understand the latter, that is a way to relate it to a practical consideration and not to the abstract tool which is used to prove many of the propositions in the first part of the book.

In this paper we scrutinize the metaphor of “photograph” and the related one of “man from the moon” in Sraffa’s papers leading up to his 1960 book, in his annotations in his books and in his correspondence. We show that the main purpose of the first metaphor was to emphasize the most important distinguishing feature of the classical approach to the theory of value and distribution as compared with the marginalist one. While the former analyses a given system of production with regard to its properties concerning income distribution and relative prices, the latter confronts the given system with an imagined adjacent system, as is reflected in concepts such as marginal productivity and marginal cost. The metaphor of the photograph was meant to express the focus on a given system and the absence of changes in outputs and factor input proportions. The metaphor of the man from the moon was meant to express the data from which the classical theory of value and distribution starts its reasoning, which differ markedly from the marginalist data: given quantities of commodities as inputs (including means of subsistence of workers), on the one hand, and outputs, on the other. “Natural prices” or “prices of production” are fully determined in terms of these givens. In this context it is perhaps interesting to point out that up until the final stage of preparing his manuscript for print, Sraffa tinkered with the idea of giving the book the title “Production of Commodities by Commodities”. This is fully in accordance with the man from the moon metaphor and expresses well the objectivist nature of the analysis. We touch upon the relationship between Sraffa’s analysis and “a purely natural science point of view” by commenting on a statement in a book by Pantaleoni, Sraffa had annotated. Finally we show that Roncaglia’s use of the metaphor of photograph is in the spirit Sraffa had intended.

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