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**ON SOME CONTROVERSIAL ASPECTS  
OF SRAFFA'S THEORETICAL SYSTEM  
IN THE SECOND HALF OF THE 1920s<sup>1</sup>**

**1. Hermeneutic questions to be addressed.**

In spite of the very extensive literature that has accumulated over time concerning Piero Sraffa's theoretical system, several significant issues pertaining to the interpretation of the work of this distinguished economist are still unresolved. In this article we will address some points relating to the period 1925-1930, in which Sraffa set out his criticism of Marshall's theory of value and began to shape the basic theses that would be put forward later in his 1960 book. It is a five-year period which opened with his famous 1925 essay on the relations between cost and quantity produced; which continued with the 1926 article in the *Economic Journal*, on the law of returns, and closed with two short papers in the same review, contributing to the debate promoted by Keynes in 1930 on increasing returns and the *representative* firm.

Four historiographic and analytical questions regarding this period seem to be in need of further clarification. First of all, one may ask why Sraffa chose to level his criticism against Marshall's theory of value,<sup>2</sup> in which marginalist analytical tools were applied for the first time to a classical conceptual structure,<sup>3</sup> rather than launching a direct attack on Jevons, Menger and Walras, who had tried to reduce the whole of economic science to the working out of the implications of the marginalist postulate.

If we may assume that even during that early phase Sraffa's main objective was to criticise the subjectivist approach to the theory of competitive values and to revive the classical doctrine based on the real cost of production, relieved from the labour theory of value, then we may wonder why he chose to contrast his ideas with the views held by an eminent scholar whose theoretical position was nearly midway between classicism and pure marginalism. The opinions expressed by those who defended a thesis diametrically opposed to his own might have been a more fitting butt of his polemics.

We will attempt to outline an answer to this issue in the first part of this study, by concentrating not so much on the supposed reasons of academic convenience that have all too often been invoked, but rather on methodological and analytical arguments, clearly expressed in Sraffa's 1925 article. Basically, they consist in the idea that Marshall had built a theory of value based on two assumptions

that overtly contrasted with the classical vision of price formation,<sup>4</sup> and had made an improper use of Ricardo's thought on that matter, exploiting it for his own aims.<sup>5</sup>

A second aspect of Sraffa's theoretical path which needs to be further studied is the question as to what led him, in the short period of time running between his 1925 and 1926 articles, to change his approach to the problem of price formation and to express the hope that the theory of value would free itself from the hypothesis of perfect competition and move in the opposite direction of monopoly. Up to that moment, his strategy had aimed merely at opposing Marshall's assumption of a supply curve of the competitive firm showing variable unit costs.

We know that in June 1926 Sraffa had already reached this conviction. At that time, he wrote to Keynes that he felt the theory of prices could not restrict itself to studying a first approximation assumption, such as Ricardo's hypothesis of constant returns, which he thought to be "the best available for a simple theory of competition". His idea was that an approach to the problem based on imperfect competition was analytically preferable, for practical reasons, to that of a general economic equilibrium ("Pareto's point of view"). "I am now trying to express in a simple form" - he wrote to Keynes - "how equilibrium can be achieved in such conditions, which I deem to be fairly good approximations to certain aspects of reality".<sup>6</sup>

Given these premises, one might have expected Sraffa to set out decisively on the road of imperfect competition. Or, failing this, to try to adapt Pareto's point of view to an analytical context of imperfect competition, thus anticipating the later developments by Negishi, Benassy, Laffont and other theorists who supported the idea of a general equilibrium of imperfect competition.

But things moved in a quite different direction. Sraffa soon abandoned the road of imperfect competition - between 1927 and 1928 - and with it the study of semi-monopolies, or polypoly. This was a form of market he considered to be predominant in the real world. He believed it would represent the most appropriate way to build a theory of value that would not be limited to the particular case of constant returns, where price determination could be separated from quantity determination. The reasons why he abandoned this road have not yet been wholly clarified. They will be dealt with as a third specific point of investigation in the course of the present work.

Once again, this choice by Sraffa lent itself to a methodological explanation, pointing out the analytical need to introduce into the theory of determination of competitive price a subjective demand curve, faced by the firm - an assumption in conflict with the tenets of the objective theory of value that Sraffa intended to defend. On the other hand, the determination of the equilibrium of an imperfectly competitive firm could not fail to resort to Marshall's

method of partial equilibria, the use of which Sraffa deemed to be legitimate only within the framework of a first approximation analysis. This silent choice which Sraffa made was, however, unlikely to be easily comprehended, for it implied the abandonment of a research line that had appeared promising to many scholars who had discussed his 1926 article.

It was probably at this point, in winter 1927-1928, that Sraffa started to think about a multisector linear model of production of commodities by means of commodities, capable of highlighting the structural interdependence among the various industries. Sraffa himself has recalled that in 1928 he had discussed the main lines of such a project with Keynes (who had suggested, should Sraffa's analysis of the problem not presuppose constant returns to scale, to inform the readers of this fact).

Searching for the reasons underlying this final methodological choice made by Sraffa represents a fourth specific problem considered in the present investigation.

Sraffa's theory of prices of production did not include any functional relation between costs and quantity produced, a circumstance testifying to a basic continuity in the author's theoretical vision. It started out from a very restrictive premise: that the quantities of commodities produced in the system were given., so that any influence of demand on prices was to be excluded a priori (except for

that part of demand which could be directly linked to the technical requirements of reproduction).

The heuristic limits which characterised such a theoretical framework could hardly pass unnoticed. If Sraffa's aim was to repropose the Ricardian explanation of prices of production, exclusively centred on the supply side - albeit in a new analytical form that could relieve it of the useless weight of the labour theory of value - then the theoretical model that he had selected for this purpose was inevitably doomed to appear unconvincing, since it was based on assumptions that excluded any different analytic perspective from the very start.

Thus the question arises as to what induced Sraffa to make such a choice. The answer is simple: the idea of isolating the production system at a given point of its evolution made it possible to focus attention upon certain properties Sraffa thought to be essential for any economic system - those independent of variations in the volume of production and in the proportions among the "factors" utilised. If the quantity of commodities produced, the technology of the system and one of the two main distribution variables were known, all relative prices of production could be simultaneously determined, together with the other distribution variable.

In order to abstract from the demand side of the problem while considering the extent to which the relative prices of

commodities would change when social distribution of income changes, it would have been necessary to assume, against all logic, that changes in the distribution pattern and in relative prices did not induce variations in the volume and composition of expenditure and in production techniques.

It is well-known that Sraffa did not pursue his research on the problem of value and distribution beyond this initial stage. To promote a return to the classical approach to the problem, which he felt had been "submerged and forgotten" by Marshall and the marginalists,<sup>7</sup> it was natural to delineate an appropriate analytical context, by formulating a set of suitable assumptions, provided that they were regarded as destined to be removed at a later stage. Unfortunately, however, this later stage never occurred in Sraffa's analysis of the problem.

## **2. The methodological issue and the reasons for a sudden abandonment.**

In the mid 1920s, Sraffa focused his attention on the so-called laws of returns, which had been called into question a few years earlier by Clapham for their lack of empirical content.<sup>8</sup> In 1925, Sraffa decided to examine the validity of such a critique from a different



perspective, being that of economic logic. He believed that both the hypothesis of increasing productivity and that of diminishing productivity, which he deemed to be of heterogeneous nature,<sup>9</sup> required the presence of conditions contrasting with Marshall's logic of partial equilibria.

Some time later, in the preface to his 1960 book, Sraffa recalled that this idea had led him "in 1925 to try to demonstrate that only the case of constant returns [was] generally compatible with the premises of economic theory". That is to say, with Marshall's assumption of perfect competition.

Only one year later, upon Keynes' request, Sraffa summarised the contents of his 1925 essay for English readers. In the second part of his 1926 article, however, he suggested a different theoretical framework: one that would associate, as in a monopoly, a diminishing demand curve faced by the individual firm with curves of average and marginal cost characterised by various possible shapes.<sup>10</sup> This analytical approach involved an implicit resumption of Marshall's pattern of price determination, whose basic premises (the partial equilibrium method and the law of non-proportional costs) were satisfied.

In that article, Sraffa clarified the changes he believed should be introduced into Marshall's framework in order to make it more consistent and extend the scope of its validity.<sup>11</sup> Thus the content of

that article did not represent a simple extrapolation of the line adopted earlier by Sraffa. On the contrary, it was objectively at variance with his earlier stance.<sup>12</sup>

The possibility that this theoretical position might give rise to misunderstandings was perhaps initially underestimated by Sraffa. Only later would he realise the extent of this risk. This awareness came gradually, presumably between 1928 and 1929, when Sraffa was preparing his Cambridge lectures on the advanced theory of value<sup>13</sup> as part of a course that would cover the entire historical development of the subject, from Petty and the Physiocrats to Marshall and Pareto.

It was at that time that Sraffa resolved: i) to abandon Marshall's method of partial equilibria once and for all<sup>14</sup>; ii) to relinquish the idea of further pursuing his study of the hypothesis of imperfect competition; and iii) to change direction of search and move towards the construction of a more general theory of prices.

This reading of the evolution of Sraffa's thought seems to be widely shared by its interpreters. The prevailing idea is that, shortly after publication of his 1926 article, Sraffa changed his mind about the usefulness of developing the Marshallian approach to the theory of the firm in terms of imperfect competition,<sup>15</sup> and concluded that such a route was impracticable for analytical reasons and the whole theory of price should be rebuilt on a different basis.<sup>16</sup>

In support of this interpretation, it has often been recalled that during the 1930 debate with Robertson and Shove on the subject of increasing returns and the “representative firm” (two of the so-called "empty boxes" of the Marshallian theory), Sraffa made no mention of any imperfect competitive solution. On that occasion, he argued that Marshall’s partial equilibrium analysis was of very restricted validity and should be replaced by a different analytical approach, capable of leading to simultaneous determination of prices in all industries<sup>17</sup>.

The theoretical model that Sraffa had in mind at that time was probably similar to the Walrasian system of general competitive equilibrium, which Sraffa considered an analytical construction of remarkable interest, although too abstract and complex to be of any practical use (see Sraffa 1926: 540-1). However, it diverged from the Walrasian model on a very important point: the formal symmetry of the roles attributed by Walras to demand and supply. In Sraffa’s long-term conception of price determination only the role of supply was relevant.

From this point of view, Sraffa’s picture of the problem was not far distant from Marshall’s vision of the process of determination of normal long-term prices. Marshall held that one could describe such prices as governed by cost of production, but with a significant proviso: that "he does not claim scientific accuracy for the wording of

his doctrine, and explains the influence of demand in its right place" (Marshall 1961 [1890]: 291).

Sraffa raised three main objections to Marshall's method.<sup>18</sup> The first concerned Marshall's definition of individual industries as the exclusive consumers of a given production factor or as the exclusive producers of a given commodity.<sup>19</sup> Sraffa maintained that this reasoning could affect the type of returns to scale, inasmuch as increasing returns tend to be all the more probable - and diminishing returns less and less probable - the broader is the definition of industry.

According to Sraffa, only in two exceptional cases could Marshall's approach possibly be reconciled with a supply curve with variable costs: first, for increasing returns, in the case of economies of scale which were external to each individual firm, but internal to one individual industry undergoing expansion (an improbable category of economies, analysed by Marshall and Pigou); second, for diminishing returns, in the case studied by Barone concerning an industry utilising the whole quantity of a given production factor, regardless of whether its total product increased or diminished. The scope encompassed by Marshall's approach was therefore rather limited.

This methodological attitude was linked with the criterion Sraffa had adopted to determine whether or not it was licit to resort to Marshall's *ceteris paribus* hypothesis, typical of the partial

equilibrium analysis. According to this criterion, changes in the quantity of commodities produced in a single industry could be overlooked only if they had not generated variable returns to scale with direct effects on the technical coefficients of other industries, since this would necessarily have resulted in price and income distribution changes (see Sraffa 1925:326-7). It was a flexible criterion, which made it possible to assume a restricted margin of interdependence among industries, and did not require, or prevent, the assumption of constant costs.

The second objection raised by Sraffa concerned the assumptions implicit in Marshall's analysis of partial equilibrium, because of its recourse to the *ceteris paribus* clause. They implied that production costs and the level and composition of the social product could be determined independently of output prices, and that the supply curve of each commodity was unrelated either to those of other commodities, or to the demand curve. Sraffa held that, in general, such assumptions could not be satisfied, because any small change in the quantity of commodities produced by a given industry could affect the production costs of other industries. One should rather recognise the interdependence relations of technological nature which linked different industries on the supply side.

The third objection that Sraffa raised against Marshall's theory of value was that, in a free competition context, an increase in

production costs due to the presence of a limiting factor would be borne by each of the industries that made use of such a factor; but not necessarily by each firm, since each individual producer could increase or reduce the quantity of the scarce factor used, without substantially affecting its price,<sup>20</sup> a state of things which is clearly inconceivable for all producers as a whole.

This line of reasoning prevented Sraffa from conceiving the aggregate supply curve of an industry over the short period as a horizontal sum of the individual supply curves, as Marshall had done. On the other hand, it became even more difficult to accept the assumption of constant prices for all the other commodities - a typical assumption of a partial equilibrium analysis - as some of these commodities were likely to require precisely the use of that scarce and irreplaceable factor whose price was susceptible to increase.

As far as the case of diminishing costs due to external economies was concerned, a case logically admissible within Marshall's theory, Sraffa considered it to be a "purely hypothetical and unreal construction" which would lead to the same result. He thought that diminishing costs could not be presupposed in the construction of an industry supply curve, on account of the difficulty in summing individual cost curves whose shapes would change with variation in the quantities produced at the industry level.<sup>21</sup>

### 3. The real reasons accounting for Sraffa's criticism of Marshall.

A number of Sraffa's interpreters have wondered what led him, in 1925-1926, to take Marshall's version of the neoclassical theory of value - or one of its current *vulgata* - as the main butt of his criticism. That is to say, to refute precisely the version of the dominant theory that aimed to mediate between the classical and the marginalist viewpoint,<sup>22</sup> rather than other more canonical versions of that doctrine.

Some of the answers that have been put forward to this question in the literature are rather perplexing. It has been suggested that the young Sraffa may have criticised Marshall's doctrine either because at that time Marshall was very popular in Italy, where he was considered the most important representative of neoclassical economics<sup>23</sup>; or out of misconceived career motivations (curiously described as *reasons of "academic policy"*)<sup>24</sup>. It has also been claimed that the idea of demonstrating that Marshall had not succeeded in abandoning Ricardo's theoretical model may have appeared rather attractive to a young critic of marginalism, impatient to get ahead and be noticed and understandably sensitive to the assessment of his work within the academic world<sup>25</sup>.

Yet Marshall's theoretical vision was no longer predominant in Italy in the mid-1920s. As Sraffa himself recalled, reservations,

restrictions and exceptions to Marshall's theory had long been present in notes and articles, even though an overt criticism of the theoretical construction of the English economist was carefully avoided.

With remarkable modesty, Sraffa presented his 1925 essay as a mere attempt to coordinate the pre-existing critical material. It is therefore difficult to imagine that he chose Marshall's theory of competitive price as the main target of his criticism merely because he thought it would represent the ideal subject for a scientific scoop.

Other interpreters have preferred to adopt an approach that does not cast doubt on the young Sraffa's intellectual honesty, pointing instead out purely analytical reasons. Thus some have appealed to the clear advantage, recognised by Sraffa, of addressing the research to a solution of partial equilibrium of imperfect competition, rather than moving towards a far more complex solution of general economic equilibrium.<sup>26</sup> Others have spoken of the possibility of thereby avoiding an unnatural mixing of objective cost functions and subjective demand functions.<sup>27</sup>

In my opinion, Sraffa had two specific reasons for criticising Marshall. The first is that he believed Marshall to have made improper and historically distorted use of Ricardo's thought on the issue of value<sup>28</sup>. From this point of view, I think Sraffa's criticism of Marshall for not assuming constant returns in perfect competition implicitly tended to defend Ricardo, giving Marshall a dose of his own medicine.



Marshall had indeed offered a somewhat simplified interpretation of Ricardo's theory of value, presenting it as an explanation of price based on the real production cost, under constant returns to scale.<sup>29</sup> Sraffa intended to show that once Marshall's theory was reformulated in a consistent manner, it implied a constant average cost, just as did Ricardo's theory.

So far, on Sraffa's part, there was neither an explicit acceptance of Marshall's approach to the theory of competitive price, nor a definitive rejection of it. Sraffa's behaviour in the mid-1920s revealed his concern to leave a door open a window to opportunity, which might allow Marshall's approach to be revived, once it had been clarified that his theory could not be interpreted as a completion of Ricardo's approach.<sup>30</sup> Only later, during the 1930 debate on increasing returns, did Sraffa make a more decisive rejection of Marshall's method of partial equilibrium analysis and of his theory of competitive price.

On the issue of returns to scale, both Marshall and Sraffa failed to interpret Ricardo correctly, as the latter had spoken of freely reproducible commodities, not of commodities produced at constant costs.<sup>31</sup>

I think Sraffa felt Marshall had sought to deprive Ricardo's theory of value of its most typical feature, namely the fact that in the long period it focused only on supply, and to encompass it within a

more general analytical context that would also cover shorter periods of time, in which price determination would involve an equilibrium between demand and supply.

Sraffa saw Marshall as the author of the erroneous doctrine which stated the "fundamental symmetry of the general relations in which demand and supply stand with respect to value". A doctrine

conditioned by the non proportionality of total production cost to the quantity produced: if the production cost of each unit of the commodities considered did not change with variation in the quantity produced, the symmetry would be interrupted, the price would be exclusively determined by production costs and the demand could not affect it at all.

(Sraffa, 1925, p. 320)

Basically, then, Sraffa considered Marshall's theory of competitive price as an unjustified and insidious attempt at reformulating Ricardo's doctrine in the neoclassical language of market equilibrium.<sup>32</sup> In his opinion, Marshall had purposely and surreptitiously overturned the main theoretical results which Ricardo had achieved.<sup>33</sup>

I am thus advancing here a crucial historiographic hypothesis on which my interpretation of Sraffa's theoretical work in the mid-1920s will rest or fall.

#### **4. The two articles of 1925 and 1926, and some of their interpretations.**

Some commentators have maintained that Sraffa's 1925 and 1926 articles are very similar to one another ("twin papers"), suggesting that the second is little more than a synthesis of the first. In my opinion, on the contrary, they display a number of significant differences.

In his 1925 article, and in preparatory notes discussed with his friend Raffaele Mattioli, Sraffa examined some formal contradictions in Marshall's analysis of the equilibrium of the firm and industry under perfect competition. In essence, he there explained three things:

*a)* why he felt he could not accept Marshall's statement that there was a "fundamental symmetry of the general relations in which demand and supply stand with respect to value" in the theory of competitive price;<sup>34</sup>

*b)* why he regarded as inadequate an analysis of the theory of the firm carried out along lines of partial equilibrium and grounded on that symmetry premise;

c) why he intended to support validity of the classical approach to the theory of long-term competitive prices, an approach which denied that symmetry.

Sraffa's main thesis was that, in the study of relations between cost and quantity produced of an individual commodity, one was faced with a basic methodological alternative. Either one could abandon the assumption of perfect competition, implying production at constant costs - something to be considered as an exception from the empirical point of view - and replace it by another, less restrictive hypothesis, or else he should give up Marshall's method of partial equilibria, which allowed "only a first approximation to reality" and did not seem to be capable of reconciling the need for logic consistency with the requirements of realism.

In Sraffa's opinion, the supply curve of a firm and the corresponding demand curve were not independent from one another (even in the absence of advertising and selling expenses, which he did not include among production costs). The same reason that led Marshall to attribute to the firm's supply curve an increasing upper portion - that is, the probable rise in the rental price of certain production factors as a consequence of the expanding volume of production - likewise caused Sraffa to believe that if a similar phenomenon had also occurred in other industries, the demand would have been affected in such a way as to make it impossible to determine

the equilibrium of the competitive firm, due to the temporary shift in the two curves of demand and supply.

Significantly, the 1925 article concluded with a criticism moved to Marshall's method of partial equilibrium for not allowing the interdependencies to be taken into account. The method, Sraffa contended, could be applied only to small variations in the quantity produced. That is, only to changes that did not substantially modify the general framework of the analysis. Large changes would have resulted in considerable variations in the prices of factors used in other industries as well, a circumstance that would necessarily have required the abandonment of Marshall's partial equilibrium analysis.

In the 1925 article Sraffa contested Marshall's attempt at building a supply curve of industry that would co-ordinate several different tendencies of factor productivity under a single "law of non-proportional costs". He examined a series of analytical problems affecting Marshall's analysis of partial equilibrium; showed that, from a logical point of view, the hypothesis of equilibrium of the perfectly competitive firm was indissolubly linked to production at constant costs,<sup>35</sup> and pointed out that the shape of Marshall's supply curve implied that the increase in aggregate demand concerned only one commodity, with no external effects on more than one industry.

No new theory of price, however, was contained in Sraffa's 1925 essay. It simply proposed a return to the idea of a supply curve at

constant costs. From this point of view, the 1926 article - which Sraffa considered to be a sequel, rather than a mere summary, of the previous one<sup>36</sup> - was certainly more significant. Not only did it suggest abandoning the usual assumption of perfect competition in favour of a revival of the less constraining classical assumption of free competition,<sup>37</sup> but it also proposed to apply to the latter analytical context the formal apparatus of monopoly theory. It thus introduced an important innovation, which was to lead to a radical review of the concept of industry, laying the basis for its subsequent identification with the market of the products of each individual enterprise.

Sraffa's proposal was to build a new theory of price for substantially similar, but not identical, commodities. The hypothesis was that such commodities were offered at variable unit costs by quite a number of firms competing with one other in price and product quality. Each firm was assumed to be facing a diminishing demand curve, more elastic than in a monopoly. A circumstance which would limit the expansion of supply by each individual producer.

The innovative nature of this proposal was immediately grasped in Cambridge, not only by the two editors of the *Economic Journal*, Keynes and Edgeworth, but also by Pigou and by Kahn and Joan Robinson, two exponents of the younger generation of Keynesian scholars, still linked to Marshall's approach to price theory.

Later on, however, some of the Italian interpreters of Sraffa cast doubts on the real importance of his 1926 article. Following Schumpeter, they judged it to be of inferior quality as compared to his preceding essay<sup>38</sup> and described it as a deviation from Sraffa's previous line of reasoning.<sup>39</sup>

The most scathing judgements on the article considered its first part as a mere reformulation - the "English version", requested by Keynes - of the previous essay, and its second part as a temporary abandonment of the line of thought envisioned in 1925. This supposed change of direction was ascribed to the desire to show the logical possibility of a competitive equilibrium of the firm compatible with the assumption of increasing returns to scale.

The deviation was regarded as unacceptable for several reasons: first of all, because it tended to carry out "a theoretical operation that was totally contained within Marshall's vision of the industry equilibrium of a single product" (Talamo 1976: 63); secondly, because it seemed to make concessions to demand and consumer preferences (see Graziani 1986: 191); and thirdly, because it infringed the rules of the game by introducing into a theoretical framework hints of daily experience and businessmen opinions.<sup>40</sup>

It should be noticed that all these interpreters had some sympathy for Sraffa's work as a whole. But it was precisely for this reason that they felt it to be their duty to go beyond, or even against,

the statements expressed in his 1926 article. They were probably convinced that by so doing they were working in Sraffa's own interest, raising the overall coherence of his scientific programme, which, in their view, could not imply a theory of price where demand played a significant role.

These developments resulted in a curious *conventio ad excludendum*, which led many Sraffian scholars to ignore his 1926 article, as if it had never been written or consisted merely in an English-language summary of the previous essay. Moreover, there has been a large tendency to trace a substantial line of continuity between the theoretical approach adopted in Sraffa's 1925 article and that contained in his 1960 book.

Sraffa's second article was thus passed over almost in silence. The spotlights remained trained on his first essay. Even though Sraffa himself made it clear that it no longer adequately expressed his thought (to the point of preventing its publication in an English version).

The outcome of this process has been a systematic misunderstanding of the meaning of the 1926 article, which was ultimately considered by these interpreters of Sraffa's thought as a bungled attempt, which ended up in a blind alley, to move away from his previous theoretical line.



## 5. Samuelson's frontal attack and its effects.

One of the main conclusions drawn by Sraffa in the two articles we have just examined is that the production cost of the commodities offered by a perfectly competitive firm must generally be seen as constant with respect to small changes in the quantity produced, "as we are not entitled to take into consideration the causes which may make it rise or fall" (Sraffa 1926: 541).

This conclusion was opposed by Samuelson, who held it to be an ideological statement, not deducible from Sraffa's analysis and flawed by a simple, but fatal error: the failure to recognise that the condition of static equilibrium of a perfectly competitive firm requires an increasing supply curve, so as to preclude indefinite expansion of the business production scale.<sup>41</sup>

So far, the arguments produced in defence of Sraffa against this frontal attack on his theoretical construct have not been fully convincing. The main point, raised by Garegnani, was that the rule recalled by Samuelson would be valid only under conditions of general economic equilibrium, where the production-possibility frontier for an industry, in the presence of limiting factors (such as land), would assume a concave shape, expressing increasing unit costs. Whereas Sraffa had objected to the Marshallian use of such supply curves in a more restrictive partial equilibrium context –

namely in a model with a single homogeneous primary factor, labour, implying constant unit costs and a linear production-possibility frontier. In the presence of scarce land, however, or dishomogeneous labour, Marshallian rising supply curves would be justified.

The logic on which this line of defence was founded was rather weak, for it referred to Sraffa's treatment of the matter as if his assumption of constant unit costs were only a first approximation hypothesis, used for analytical convenience and destined to be subsequently abandoned.

Sraffa's intention was to show not so much the lack of empirical content in Marshall's theoretical construction (as Clapham had tried to do), but rather the restricted nature of Marshall's predicative field, which implied a constant supply curve for the industry, logically incompatible with a symmetrical theory of value. Once this result had been achieved, there was no further motive for Sraffa to proceed along this line of reasoning, instead of recognising the existence of a more general functional relation between cost and quantity produced. Indeed, that is what he ultimately did.<sup>42</sup>

Sraffa believed that Marshall's method could coherently account only for two special, and highly unlikely, cases of variable costs by a competitive firm. Therefore he thought that, *as a first approximation*, one could assume as normal the case of a supply curve at constant costs:

"The low probability of the hypotheses that give rise to each of the tendencies to cost variability seems to suggest that the absence of both is to be considered much more general - given the conditions of partial equilibria - than the presence of only one of them. Thus the most appropriate approach is to regard as normal the case of constant costs, rather than that of increasing or diminishing costs".

(Sraffa 1925: 316)

But Sraffa knew very well that, in a further approximation to reality, it would become "necessary to extend the field of investigation so as to examine the conditions of simultaneous equilibrium in numerous industries" (Sraffa 1925: 541) - which he did in his 1960 book - and to take into account the circumstances which could result in external economies (as he had done in his 1925 essay).

As a matter of fact, in the closing sentence of his 1925 essay, Sraffa had stated that from the point of view of the equilibrium of a single industry, "which is only a first approximation to reality, it must be admitted that the commodities, in general, are produced under constant cost conditions". Later, however, he came back to the same point and recalled that in 1925 he had intended to demonstrate that, in general, only the case of constant costs could be considered as logically compatible with the assumption of perfect competition, without mentioning that it was a first approximation hypothesis.<sup>43</sup>

Thus Samuelson's criticism – his ironic reference to a “one-leg theory of price” lacking the demand side - has a sound basis as far as this aspect is concerned. In attempting to re-launch the classical theory of prices of production, Sraffa actually restricted his attention to a special case of the theory of value,<sup>44</sup> a case which he legitimately dealt with as a first approximation to the problem. He then neglected to remove this initial assumption, and seemingly went on in the construction of his theory of prices almost forgetting its obtrusive presence.

A second line of defence of Sraffa's work sought to provide a more specific textual basis for opposition to Samuelson's attack, by recalling that Sraffa's aim in 1925-26 was not to deny any role of demand in the determination of competitive values, but rather to single out, among Marshall's supply functions, those that were endowed with a rigorous foundation and those which were not.<sup>45</sup> It was also maintained that Samuelson's interpretation of Sraffa's critique of Marshallian supply functions did not give a correct account of the issue, failing to recognise that Sraffa had ultimately abandoned the Marshallian partial equilibrium approach in favour of a more general analysis of simultaneous determination of long term competitive prices.

Samuelson was definitely wrong when he contended that Sraffa ignored the fact that a competitive equilibrium of the firm

requires an increasing supply curve. This issue is grounded on a substantial misunderstanding of the contents of Sraffa's 1925 article - a paper which had not yet been translated into English and did not make for easy reading.

In his 1925 essay Sraffa had indeed warned his readers against the risk of making precisely the "fatal mistake" that Samuelson later attributed to him:

"In the perfectly possible case that the individual marginal cost were constant for some or even for all the quantities of product, in the part concerning such quantities the marginal cost curve would correspond to the average cost curve; and within these limits the equilibrium would be indeterminate, given the definition of competition that we have followed so far... Under such circumstances, if the unit cost curve is constant for a given tract, equilibrium will be achieved at the point corresponding to the maximum quantity which can be produced at that cost; *and it will no longer be admissible to claim that the curve is at constant costs throughout, as this would lead to the monopoly of the firm considered*" (italics added).

(Sraffa 1925:311)

Sraffa never held that constant cost cases exhaust the categories of admissible competitive prices, as claimed by Samuelson. Indeed, he argued exactly the opposite: that two cases of variable unit

costs, both of them consistent with the assumption of perfect competition, were theoretically conceivable.

## **6. Real, presumed and missing influences on Sraffa's work.**

After his 1926 article, where imperfect competition was envisioned, Sraffa began to consider the idea that in order to repropose the “the old and now obsolete theory” of price based on the real production cost - which he still regarded as the best available - he should follow a different path, that based on the analysis of multisector linear models of production. This type of analytical approach was later to become known as the “neo-Ricardian approach”. It drew on a solid theoretical background: that of the Russian-German school of mathematical economics.

The main representatives of that school - Dmitriev, Tugan-Baranowsky, Bortkiewicz, Struve, Charasoff - had attempted to explain the process of determination of the normal profit rate by combining Ricardo's analysis of value and distribution with the Walrasian theoretical system and with a revised version of Marxian reproduction schemes, criticised by Böhm-Bawerk.

Those scholars had undeniably achieved some important theoretical results. Dmitriev had shown that, given the technical

conditions of production and the real wage rate, the relative prices of commodities could be determined by two distinct analytical methods, together with the uniform profit rate, which depended exclusively on the technical conditions of production of the vertically integrated wage goods subsystem. For an economy where each commodity was produced by a separate industry, he had identified the inverse functional relation between wages and profits, which plays a fundamental role in Sraffa's solution to the problem of choice of techniques.

Bortkiewicz, in turn, had formally solved the Marxian problem of transformation of values into prices, both by using for this purpose Dmitriev's equations of reduction of prices to dated quantities of labour and by re-setting Marx's extended reproduction schemes correctly, so as to determine relative prices and the profit rate simultaneously. Charasoff had then generalised to  $n$  commodities Bortkiewicz's solution to the problem.<sup>46</sup>

The names of these scholars are not recalled among Sraffa's bibliographical sources, where only Marx and a few classical authors are mentioned. Unfortunately, little is known about the range of works read by Sraffa in the 1920s and early 1930s. We are therefore confronted with a delicate historiographic question: whether the young Sraffa, who had an interest in Marxism and could read German, was at that time already acquainted with the 1905 critical essay by Tugan-

Baranowsky on the theoretical foundations of Marxism and with two famous studies by Bortkiewicz on Marx's theoretical system, published in 1906-1907, both of which contained extended references to Dmitriev's essay on Ricardo's theory of value and distribution and to the work of Tugan-Baranowsky.<sup>47</sup>

By replacing in Bortkiewicz's Marxian transformation model the quantities of labour with the corresponding quantities of commodities included in a physically specified subsistence real wage, we get the price model without labour coefficients described in the first two chapters of Sraffa's book.<sup>48</sup>

By the early 1940s, Sraffa was certainly familiar with these writings.<sup>49</sup> By that time various contributions had been published in English on the subject (by Sweezy, Dobb, Winternitz and May). It is not easy, however, to ascertain whether Sraffa was acquainted with these works of the Russian-German school when in 1928 he submitted a preliminary draft containing the central propositions of his theory of prices to Keynes.

Anyway, in his analysis of the determination of prices of production, Sraffa went further than the neo-Ricardian economists of the Russian-German school, as he succeeded in demonstrating that relative prices of commodities can be determined without even passing through the intermediary of values.<sup>50</sup>



Let us now explore another significant issue: why Sraffa's long intellectual fellowship with Keynes did not exert any substantial influence on the theoretical work of the Italian economist. This lack of influence may indeed appear strange if one considers that Keynes and Sraffa were both deeply committed to a critique of the dominant neoclassical paradigm, and both took the relation between special cases and the premises of economic theory as the butt of their criticism. Their critical targets thus coincided, but the levels of abstraction on which the two authors had chosen to operate were different.

Furthermore, Sraffa was mainly interested in a long term issue, namely the relation between prices of production and the distribution of the social product. In his theoretical system, final demand played no role; neither did money.<sup>51</sup> Keynes, on the other hand, was pursuing a typical short term issue, where the role of demand was most important: that of determining the overall level of utilisation of resources, when the production capacity of the economy was taken as given.

Sraffa's attention focused mainly on testing the internal consistency of the dominant theory. He criticised it on purely logical grounds.<sup>52</sup> Keynes, by contrast, put forward an external criticism, centred on the irrelevance of the basic neoclassical assumptions for a correct understanding and interpretation of reality.

Sraffa, as we know, was closely linked to the Ricardian-Marxian theoretical tradition. Keynes, who was a liberal and had a much more pragmatic attitude, found little he could share therein. His political project strove to achieve internal reform and improvement of the very capitalist system that Sraffa would perhaps have preferred to replace with a new social order. Yet, in spite of these divergences, scientific collaboration between the two scholars might have been attained. The introduction of the Keynesian principle of effective demand into a pattern of long-term analysis of the Ricardian type might have made it possible to establish an organic link between price theory and the Keynesian theory of income and employment.

The highest point of scientific relations between the two scholars was Sraffa's contribution to an ongoing debate between Keynes and Hayek on the theory of capital, in 1932. It played a decisive role not only in determining the outcome of that debate, but also in orienting Keynes' subsequent thought on the theory of investment.

Soon after this episode, Sraffa fell into a twenty-year period of silence, right up to 1951, when his introduction to Ricardo's *Principles* was finally published. During that long period of time, Sraffa had no teaching duties. His role as head of the Marshall Library and assistant director of research for economic studies must therefore have left him considerable time to devote to his studies. He was

however engrossed in preparing the critical edition of Ricardo's works, which kept him engaged up to 1955.

At a certain point his undertaking began to seem never-ending, partly due to the difficulty of locating Ricardo's letters and partly to the task of writing the introductions. Throughout the last few years of that period Sraffa was also working on the subject of prices of production.<sup>53</sup> He was eventually almost overwhelmed by this combined effort. Maurice Dobb's contribution was of decisive importance for the accomplishment of the editorial work.<sup>54</sup>

If one were to reach the conclusion that the prolonged breakage in Sraffa's scientific production was due to his great commitment of time and effort to the famous critical edition of Ricardo's works and correspondence, one may perhaps wonder if Keynes had a really good intuition when in 1930 he proposed to the *Royal Economic Society* to entrust Sraffa with a task which would divert his attention from more creative activities for well over a quarter of a century.

## **7. Some concluding remarks.**

Our re-reading of Sraffa's early theoretical works was aimed at reviving a critical reflection on the origin and the significance of his

contribution to the theory of value. It has focused on the examination of four controversial aspects: (i) the reasons underlying the criticisms he levelled in 1925 against Marshall's theory of value; (ii) his 1926 decision to suggest a different line of analysis, nearer to the case of monopoly; (iii) his early abandonment of the idea of constructing a theory of imperfect or monopolistic competition; (iv) his subsequent decision to concentrate his attention on a simple model of production of commodities, suited for simultaneous determination of all relative prices.

In the course of the study, an innovative and promising historiographic hypothesis has been formulated on the probable motivations of Sraffa's criticism of Marshall's theory of value. The outcome of the study confirms the basic coherence of Sraffa's theoretical work, which aimed at reviving the classical explanation of long term competitive prices based on real production costs, relieved from the useless burden of the labour theory of value and from the presence of neoclassical elements of distortion.

Within the seemingly linear trend of this theoretical itinerary, a single methodological turning point of a certain significance may be noticed. It took place when Sraffa - soon after his 1926 article, which had opened the way to the theory of imperfect competition - unexpectedly refused to continue to move in that direction, realising

that it would imply a return to Marshall's criticised analysis of partial equilibrium and his symmetric vision of price determination.

After that abandonment – perhaps a little premature, but due to comprehensible methodological reasons – Sraffa's interest in purely abstract theory addressed itself to the study of a circular process of production, in which the same commodities appeared as products and as means of production. Faithful to his plan of re-launching the project of an objective theory of value entirely grounded on the real cost of production, he gave up the idea of a joint determination of all prices and outputs and focused his attention on a much simpler problem which concerned the construction of a theory of relative prices when the instantaneous production configuration of the economy was assumed as given. By this assumption, any functional link between supply and demand was severed, right from the beginning.

We do not know whether Sraffa was fully satisfied with that solution, or not. But he did not seem to regard it as sufficiently pervasive, as we may guess from the fact that in the preface of his 1960 book he mentioned his intention to carry forward more deeply and extensively the critical part of his research programme, or to delegate that task to “someone younger and better equipped”. Provided - he added - that the foundation of his theory of prices would hold up.

Today, forty years on, there is evidence that the base laid by Sraffa has only partially resisted the test of time and experience. It has

provided sufficient support for a critique of the most aggregate version of the neoclassical theory of value and distribution. But it has neither brought about a definitive abandonment of the general equilibrium versions of that theory, nor promoted a suitable revival of the classical approach to the problem.

As a matter of fact, Sraffa spent a great amount of his intellectual energy in the attempt to develop the theoretical implications of a first approximation assumption which could not be removed without seriously damaging his basic thesis. Ultimately, he ended up by postulating much of what he intended to prove.

His method of analysis - by distinct but coherent logical stages implying specific assumptions - involved the risk of misunderstandings. On the one hand, supporters of the theoretical approach of neoclassical synthesis sought to reabsorb his thought into the dominant tradition (as had already occurred with Keynes' theory), by looking at his theory of prices as a particular, and somewhat irrelevant, case of the more general Walrasian model. On the other hand, neo-Marxist scholars found difficulties in interpreting his attitude towards the labour theory of value, the origin of profit and the possibility of overcoming the basic contradiction between bourgeois and Marxist economics.

On the whole, there was a constant overburdening of Sraffa's line of reasoning with the idea that he was aiming at a global

reconstruction of economic science. In my opinion, such an idea was fundamentally extraneous to Sraffa, who had purposely and unpretentiously limited his attention to a few theoretical cases (that he regarded as particularly suited for making “intellectual experiments”).

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Summary:

The object of these pages is to revive a critical reflection on the significance of Sraffa's early theoretical work in the five-year period running between 1925 to 1930. After identifying the main interpretive issues, attention is focused on Sraffa's thought on the shape of cost curves and its consequences on the relationship between price and quantity produced. The issues dealt with include the real motivations of Sraffa's criticism of Marshall's theory of value. They were not reasons of personal convenience. Rather, Sraffa believed that Marshall had severely distorted Ricardo's theory of competitive value, by trying to rebuild it in terms of symmetric relations of demand and supply, in the neoclassical language of market equilibrium.

Even Sraffa's early abandonment of his search on imperfect competition - a major element of discontinuity in his theoretical path - may be traced to analytical and methodological reasons. Realising that his idea to afford the study of the behaviour of an imperfectly competitive firm on the assumption that it was faced with a subjective demand curve was in stark contrast both with the basic premises of an objective theory of value and with his critique of the Marshallian method of partial equilibria, he decided to opt for an entirely different analytical approach to the theory of price.

Notes:

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<sup>1</sup> The author thanks Neri Salvadori, the discussant of this paper at the Turin meeting in October 1998, for some helpful comments.

<sup>2</sup> In the spring of 1923, when he was in France, Sraffa read, or reread, Marshall's *Principles of Economics* and jotted down a few critical notes about some of its passages, as testified by a notebook bearing the date of April of that year, preserved together with all *Sraffa Papers* (henceforth SP) at the Wren Library of Trinity College, Cambridge (SP/D1/2). In November of the same year, Sraffa adopted Marshall's manual as a reference text for his course in political economy at the University of Perugia.

<sup>3</sup> Marshall refused to regard his theory as a sort of compromise (see a letter to J.B. Clark dated 1908, in Marshall, 1925: 416-18). He maintained that it was a general theoretical construction, within which the two opposite theories of value based on real production cost (Ricardo) and utility (Jevons) could be encompassed as particular cases. In his view, each of these two theories was correct in what it stated, but incorrect in what it denied.

<sup>4</sup> These were the hypotheses of variable unit production costs and of the fundamental symmetry in the general relations in which demand and supply stand with respect to price. See Sraffa (1925: 280).

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<sup>5</sup> Marshall interpreted Ricardo's theory of value as grounded on the assumption of constant unit costs, which excluded any role for demand.

<sup>6</sup> See a letter written by Sraffa to Keynes, from Milan, dated 6 June 1926, kept in the "Keynes' Papers", at the Marshall Library, Cambridge, partly reported by Roncaglia (1975: 17-21).

<sup>7</sup> Among the *Sraffa Papers*, there is a note remarking on the existence of a great lack of understanding between his contemporaries and classical economists, in spite of the simplicity and explicitness of the language the latter used (SP/D3/12/4:14).

<sup>8</sup> See Clapham (1922). The English historian held that some of Marshall's analytical categories were no more than "empty economic boxes", useless for practical purposes. That article started a debate with Pigou.

<sup>9</sup> Sraffa thought that the hypothesis of increasing returns could be explained by the technical division of labour within industry and regarded diminishing returns as related to the specific nature of agriculture (see note SP/D1/43: 33-34).

<sup>10</sup> According to Sraffa, what really prevented a competitive firm from expanding production indefinitely was not the presence of increasing cost, but the limited extension of demand, expressed by a price curve with negative slope.

<sup>11</sup> In his 1926 article, Sraffa himself underlined that this was the "method indicated by Marshall to the manufactures designed for particular tastes" [Marshall 1890, Book V, Chapt. 12, Par. 2], "the very same as that followed in cases of ordinary monopoly" and did not make it possible to sum the particular curves of individual firms "so as to form a single pair of collective demand and supply curves" (1926: 546).

<sup>12</sup> It is interesting to notice that before the publication of his 1925 article, Sraffa had discussed with Maurice Dobb a note containing some of his ideas concerning imperfect competition, not included in that essay. They appeared in a re-elaborated form in the 1926 article, upon the recommendation of Dobb himself .

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<sup>13</sup> A set of 220 pages of Sraffa's lecture notes, which basically reproduce material taken from the 1925 and 1926 articles, is preserved in SP/D2/4.

<sup>14</sup> Two years later, at the conclusion of the debate with Robertson on increasing returns, Sraffa asserted with emphasis that Marshall's theory of value "should be discarded" (Sraffa 1930: 93). But, significantly, he did not specify whether this should be done in favour of Cournot's point of view or that of Pareto.

<sup>15</sup> As Sraffa himself recognised, Marshall can be legitimately regarded as a forerunner of the modern theory of imperfect competition. Schumpeter considered Marshall as the father of that theory.

<sup>16</sup> See Panico (1991: 560-61). Similar ideas were also expressed by Napoleoni (1964: 175-6), and Talamo (1976: 60, 65, 73-4, 84).

<sup>17</sup> Sraffa did not make clear the reasons which led him to change his mind on the appropriateness of applying the static analysis of partial equilibrium to the theory of imperfect competition. One reason that most naturally comes to mind is the lack of plausibility of the assumption that a firm knows what kind of demand curve it is facing.

<sup>18</sup> The scarcity of studies on Sraffa's method is surprising and contrasts with the abundance of bibliographic references on the methods of Keynes, Hayek and Schumpeter. For an interesting work on the subject, covering the 1920s, see Signorino, 1998.

<sup>19</sup> Cf. Sraffa (1925: 320). Let us note that in his 1960 book Sraffa adopted precisely the definition of industry as the only producer of a given sort of commodity that he had previously criticised.

<sup>20</sup> See Sraffa (1925: 287). Sraffa held that, assuming rational behaviour by the firm in the presence of a constant factor, returns could be increasing only if such a factor were indivisible.

<sup>21</sup> Cf. Sraffa (1925: 306). Among the *Sraffa Papers* there is a note of him (SP/D1/32:21.2), probably dating from 1927, emphasising that the analytical tool of the collective supply curve could never be applied to a real industry.

<sup>22</sup> Sraffa himself had noticed this aspect some months earlier in his obituary for Maffeo Pantaleoni (Sraffa 1924: 648-53), where he maintained that in Pantaleoni's treatise of economics the theories of

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classical economists were harmonised with those of the marginalist economists, "in line with Marshall's teachings".

<sup>23</sup> Marshall's theory, in spite of Pareto's opposition, had spread rapidly in Italy through the work of two groups of scholars, namely to the Roman group that clustered around Pantaleoni, Barone and Ricci and the Turin group centring around Einaudi, Jannaccone, the "Cognetti de' Martiis" Laboratory of Political Economy and the review *La Riforma Sociale*.

<sup>24</sup> Such reasons were hinted at by Talamo (1974: 64) in a remarkable critical essay on the interpretation of Sraffa's thought, where a supposed "necessity to enter into the Marshallian head of 1925 economists with clamour" was recalled.

<sup>25</sup> See Becattini (1986: 42-3). My interpretation is different, being based on the consideration that Sraffa had no qualms in using harsh words towards "the academy", as he had openly spoken out against the techniques used to hush up the "scandal" of raising doubts on the empirical foundations of Marshall's supply curve (Sraffa 1926: 536).

<sup>26</sup> Sraffa (1926: 540). See, for instance, Panico (1991: 560), who held that Sraffa had chosen the first solution for "pragmatic reasons" of analytical nature.

<sup>27</sup> See Roncaglia (1975: 23), who, in this regard, mentioned a "hybrid of irreconcilable objective and subjective elements".

<sup>28</sup> See Roncaglia (1991: 377), according to whom "Sraffa's first critique concerns Marshall's distorted interpretation of Classical (particularly Ricardo's) analysis", and Groenewegen (1991: 82), in whose opinion Marshall "transformed these classical ideas into what he wanted them to be in order to heighten the degree of resemblance of his own notions". A similar criticism had been levelled against Marshall by W. Cunningham and W.J. Ashley.

<sup>29</sup> In an appendix to the *Principles*, Marshall had accused Ricardo of not having made explicit the hypotheses that had led him to treat the particular case of production with fixed technical coefficients as a sufficiently general case.

<sup>30</sup> See, for instance, a note by Sraffa (SP/D3/12/7:114), where he mentioned the possibility of freeing Marshall's theory from all subjective elements.

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<sup>31</sup> Garegnani has recently claimed that Sraffa's unpublished papers show a gradual evolution of his views on the classical economists, which probably led him, starting from 1927-28, to "abandon the Marshallian interpretation of the classical economists, thus turning his back on the position that underlay his 1925-26 articles" (Garegnani, 1998: 152). In my opinion, in the middle twenties there was but one of the ideas contained in Marshall's interpretation of Ricardo that Sraffa shared - and it happened to be an erroneous idea, namely that Ricardo thought that most of the commodities exchanged daily on the market were produced at constant costs (see Sraffa 1925: 316).

<sup>32</sup> Sraffa believed that Marshall had conducted his attempt rather insidiously, without declaring it explicitly, but claiming to be a follower of the classical tradition who was simply "translating" Ricardo's thought into mathematical formulae.

<sup>33</sup> In his 1925 essay, Sraffa had stated that Marshall had ingeniously concealed a radical change of approach that had come about in his thought in the 1880s, on the laws of non-proportional costs and the role of external economies. "Those laws have been replaced and Marshall has been extremely clever in pushing this transformation through almost unnoticed" (Sraffa 1925: 306).

<sup>34</sup> Sraffa held that Marshall's demand and supply curves originated from a false similarity with mechanics, a science where experiments can be repeated in substantially identical conditions (SP/D3/12/42).

<sup>35</sup> "Either we take those variations [in costs and quantities] into consideration for all the industries of the group, and then we have to shift from the specific equilibrium of a certain commodity to general equilibrium, or we neglect those variations in all industries and then the commodity examined must be considered as produced at constant costs" (Sraffa 1925: 325).

<sup>36</sup> See, to this regard, Sraffa's letter to Keynes dated 6 June 1926, already referred to.

<sup>37</sup> Free competition does not imply any atomistic subdivision of demand and supply, or any perfect transparency of the market, but only free entrance, output homogeneity and a uniform profit rate in the long term.



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<sup>38</sup> See Roncaglia (1975: 20 n.); Becattini (1986: 39); Maneschi, (1986: 11); etc.

<sup>39</sup> See, for instance, Talamo (1976: 63 and 65), who regarded the 1926 article "not as a complete theoretical proposal suggesting an alternative to the dominant approach, but rather as a simple diversion down a side road", which led Sraffa "into a dead end".

<sup>40</sup> This was deemed to be all the more serious because it occurred "with a direct, ...almost brutal, appeal to the concrete reality of the market and industry" (Becattini, 1989, p. 39). The conclusion was that "only the 1925-26 article and a half" had to be considered (ibid.: 40).

<sup>41</sup> Samuelson (1987: 458; 1990: 269). This line of reasoning implied the idea that the difficulties found in Sraffa's theory did not merely consist in the fact that it only dealt with a single case, but in the specific nature of such a case, which by hypothesis excluded any possible effect of variations in demand on output levels and prices of production.

<sup>42</sup> In his letter to Keynes dated 6 June 1926, Sraffa wrote: "Although I believe that Ricardo's assumption [constant returns] is the best available for a simple theory of competition (*viz.* a first approximation), of course in reality the connection between cost and quantity produced is obvious". However, he held that this connection was a modern idea, unknown to the classical economists, who assumed constant costs (SP/D2/4 3:79).

<sup>43</sup> "The temptation to presuppose constant returns in economic theory is not entirely fanciful. It was experienced by the author himself when he started on these studies many years ago – and it led him in 1925 into an attempt to argue that *only the case of constant returns was generally consistent with the premises of economic theory*" (Sraffa, 1960, p. vi, italics added).

<sup>44</sup> Just as the case had been sixty years earlier for Pigou, who, in a letter to Sraffa dated January 1928 (SP/C239), considered Sraffa's equations of production of commodities in constant cost conditions a "special case" of the general theory.

<sup>45</sup> See Panico (1991: 556). This distinction is inferred from the fifth and last section of Sraffa's 1925 essay, where he stated that his aim was to identify the real situations that were logically compatible

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with Marshall's model of supply curve and those which were not. On that point, see also Sraffa (1926: 536).

<sup>46</sup> Thirty years later, a second generation of the Russian-German mathematical school made wide use of circular models of production. It included Leontief and von Neumann, two authors who considerably influenced Sraffa's thought.

<sup>47</sup> Dmitriev was known in the English-speaking world, because in 1931 Bortkiewicz had devoted an entry to him in the *Encyclopaedia of the Social Sciences*, published by Macmillan.

<sup>48</sup> The only difference between the two approaches is that Bortkiewicz's system of equations classically assumes that wages are paid at the beginning of the production process, whereas Sraffa's system of equations is based on the opposite assumption that wages are paid *post factum*.

<sup>49</sup> Among Sraffa's papers, there is a notebook (SP/D1/91), started in 1943, with comments on some passages by Bortkiewicz and Dmitriev.

<sup>50</sup> Sraffa's analysis yielded also other original results, such as the distinction between basics and non-basics, the "auxiliary construction" of the standard commodity and the method of subsystems.

<sup>51</sup> I dealt more extensively with these aspects in a previous study (Cavalieri 1984).

<sup>52</sup> In Sraffa's opinion, Marshall's theory of value could not be interpreted in such a way as to endow it with internal logical consistency and, at the same time, make it compatible with the events that it aimed to explain (see Sraffa 1930: 93).

<sup>53</sup> There is however considerable evidence indicating that Sraffa did not resume his work on a neo-Ricardian theory of value until 1951.

<sup>54</sup> It is well-known that in the last few years he was assisted by Maurice Dobb, whose contribution played a prominent role in finishing the work.