WHITHER SRAFFA'S THEORY OF PRICE?

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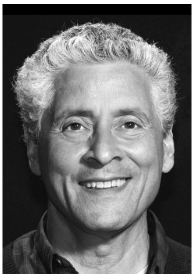

Abstract: The article looks critically at Piero Sraffa's theory of price and implied theory of money against a backdrop of renewed interest in the great economist's work. The focus is the theory of price in his *Production of Commodities by Means of Commodities*. It is argued that for all its apparent logical (read mathematical) rigor, Sraffa's explanation of prices (and implied theory of money) is (are) essentially flawed. The flaws are traced to his concern to eliminate the labor theory of value from this explanation. It is this concern that causes Sraffa to make the numerous dubious assumptions and constructs which underpin his explanation of prices and that ultimately brings into question its validity as an explanation of actual price magnitudes and their movement.

Key words: value; exchange value; price; relative price; money; surplus product; rate of profit

Introduction

Although the writings of the great Italian economist, Piero Sraffa, are hardly ever to be found on the reading lists of most university economics courses, there can be no doubting the contribution his work has made, and continues to make, to economic theory. According to Sraffa's adherents, his major contributions to economic theory have been, on the one hand, to undermine standard mainstream textbook explanations of price and distribution based on marginal productivity theory, and, on the other, to provide an alternate analytically rigorous theory of price (see Kurz 2012).[1] It is the latter that is the concern of what follows.

The particular importance of Sraffa's theory of price is that it purports to provide an explanation of price without recourse to either "subjective preference" or "labour time." This is not to say that Sraffa's theory of price is located somewhere in the ether, outside of either the Neoclassical or Classical orbits. Far from it. Even a cursory reading of Sraffa's *Production of Commodities by Means of Commodities* (*PCMC*) suggests his work is squarely located in the sphere of Classical political economy, and in particular that of David Ricardo, whose work he painstakingly edited over some considerable period of time, and also Karl Marx. Indeed, for many of his followers, Sraffa's great contribution in price theory was to complete the theories of price of Ricardo and Marx without recourse to "the unnecessary baggage" of the labor theory of value (see Roncaglia 1977; Steedman 1977).

My purpose in this article is to critically review Sraffa's theory of price, with particular attention to his *PCMC*. I propose to locate this review in the context of the now long-standing debate between Marxists and Sraffians over the relative merits and relation of Marx's and Sraffa's theories of price. I will argue that although Sraffa's *PCMC* has made a positive contribution to the theory of price by shifting the focus back to physical or real cost explanations of price, the path it maps out represents something of a theoretical dead end. I will further argue that the source of the problem in Sraffa's *PCMC* is his focus on the magnitude of price and resulting failure to pay adequate heed to how prices come to be formed. I begin by outlining in the following section what I take to be the key elements of his theory of price in *PCMC*. I then consider how Marxists have viewed this theory through both positive and negative lenses, locating my own critical comments in the context of the latter. I thereafter indicate why, and how, I see the source of the perceived defects in Sraffa's theory of price to be his failure to see how prices come to be formed, and end with some concluding remarks which include my assessment of Sraffa's legacy with respect to the theory of price.

Key Elements in Sraffa's Theory of Price?

The prices Sraffa seeks to explain are prices which facilitate the reproduction of the economic system. Referred to as exchange values or prices of production, they are the prices which permit producers to acquire the necessary inputs to reproduce outputs. As such, they are what may also be referred to as long-period, relative prices. Sraffa offers no explanation for why he begins with these prices, as opposed to, say, short-period, money prices (in the manner of post-Keynesians), or how the latter might relate to the former.

Sraffa begins his analysis of prices of production by considering the determination of their magnitudes in a subsistence economy setting. He takes a subsistence economy to be one in which no physical surplus is produced. He argues that in this setting, the magnitudes of prices can be explained by the methods of producing the commodities by means of commodities. To quote a much quoted passage in *PCMC*,

> There is a unique set of exchange-values which if adopted by the market restores the original distribution of the products and makes it possible for the process to be repeated; such values spring directly from the methods of production. (Sraffa 1960, 3)

For Sraffa, methods of production refer to the combinations of direct and indirect non-labor commodity inputs required for the production of commodities. The indirect commodity inputs include, at least in the first instance, wage goods. The relatively greater the quantity of direct and indirect commodity inputs that are required to produce a commodity, the higher would be its relative price. It is this line of argumentation that he seeks to maintain throughout the subsequent development of his price analysis.

Specifically, when he extends his analysis to a surplus product economic setting, Sraffa reiterates the basic argument that relative prices are fundamentally determined by the methods of production notwithstanding the fact that the distribution of the surplus product will also have a bearing on prices (see Sraffa 1960, 54–55). Indeed, his concern in analyzing the link between the distribution of the surplus product and prices appears to show that changes in the wage share and implied changes in the rate of profit have no predictable impact on changes in relative prices, thereby highlighting the importance of the changes in methods of production in explaining (or predicting) changes in the magnitudes of prices. It is not, contrary to many Sraffian interpretations of *PCMC* (e.g., Screpanti 1993; Mongiovi 2002), to highlight the added importance of distributional factors in explaining the magnitudes of relative prices or changes in them.

To develop this line of argumentation in a surplus product setting, Sraffa crucially distinguishes between basics and non-basics, introduces the notion of a standard economic system in which a standard commodity is produced, and assumes that wage goods can be taken as part of the surplus product—with the other part being profits. Defining basics as those goods that enter either directly or indirectly into the production of all commodities, while non-basics do not, Sraffa argues that changes in the methods of production of all commodities will have a direct bearing on the magnitudes of their prices, while changes in the methods of production of basics will have additional consequences for the relative prices of all commodities because they are inputs into the production of all other commodities and because of their impact on the rate of profit. To quote Sraffa,

> In the Single-products system this meant that, if an improvement took place in the method of production of a basic commodity, the result would necessarily be a change

> in the rate of profits and in the prices of all commodities; while a similar improvement in the case of a non-basic would affect only its particular price. (Sraffa 1960, 54–55)

Defining a standard system as a sub-system of the actual economic system comprising only basic commodities as both inputs and outputs, as well as taking wage goods as part of the surplus product along with profits, allows Sraffa to argue that changes in the wage share can have a direct impact on the rate of profit and via this on relative prices, but that the exact impact will be unpredictable given that inputs into production can be regarded as comprising successive layers, and the ratios of wages to non-labor inputs can be seen as varying between layers.

To complete the core of his analysis of the determination of price magnitudes in both subsistence and surplus economy settings, Sraffa recognizes that he needs to reduce relative prices to equivalence. He does this in the context of the subsistence economy setting by means of the choice of one of the produced commodities as *numéraire*, and in the context of the surplus economy setting through the construct of an artificial commodity, the so-called standard commodity. The standard commodity is made up of a hypothetical cluster of basic commodities in fixed proportion to one another as both inputs and outputs. Aside from reducing commodities to equivalence, the purpose of the standard commodity is to allow Sraffa to express the prices of all commodities in a *numéraire* which would be invariable to changes in income shares. Sraffa notes that

> It is true that, as wages fell, such a commodity would be no less susceptible than any other to rise or fall in price relative to other individual commodities; but we should know for certain that any such fluctuation would originate exclusively in the peculiarities of production of the commodity which was being compared with it, and not in its own. (Sraffa 1960, 18)

Sraffa (1960) gives the standard commodity dimension by taking one unit of it as "the quantity of it that would form the net product of a Standard system employing the whole annual labour force of the actual system" (20). When actually considering the impact of a change in the wage share on prices, he replaces this standard net product measure with the quantity of labor that can be purchased by the standard net product, noting that such a quantity will vary inversely with the standard wage and directly with the rate of profit (32).

Sraffa extends this basic framework of analysis in a surplus economy setting to ascertain the consequences for the determination of prices when taking into account joint products, fixed capital, and non-produced inputs. The limitations of this article preclude us following these trajectories in his analysis. Suffice it to say, that it would appear his main purpose is to show the continuing importance of methods of production in the determination of prices of commodities.[2]

Marxists on Sraffa's Theory of Price

Marxists have always had something of an ambivalent attitude toward the work of Sraffa. This is because, on the one hand, and as noted above, it has been so pivotal in undermining certain hallowed axioms of mainstream Neoclassical economics, and, on the other hand, because it has been argued by many of its adherents as also undermining Marx's theory of price and in particular the labor theory of value. Reflecting this ambivalence, one sees some Marxists as having an essentially sympathetic attitude to Sraffa's theory of price and others, perhaps the majority, including myself, having a largely critical attitude toward it.

Sympathetic Views

In the immediate aftermath of the publication of *PCMC*, a number of Marxists sought to emphasize the parallels between Sraffa's and Marx's works (see, e.g., Meek 1961), as well as the contribution of *PCMC* to overcoming certain perceived "logical difficulties" in Marx theory of price, most notably in respect of his alleged "transformation problem." In what they describe as from the standpoint of "critical sympathy" toward Marx's political economy, Howard and King argue,

> We can go further than these suggestive parallels between the Sraffian and Marxian analyses. It has been shown, firstly, that Sraffa's analysis can be translated into that of Marx, and secondly, that Sraffa's derivation of the Standard system provides a complete solution to the Marxian transformation problem. (Howard and King 1975, 155)

And in a similar vein, Meek contends,[3]

> With the specification where necessary of the appropriate institutional datum, then, and with remarkably little modification and elaboration, a sequence of Sraffian models can be made to do essentially the same job which Marx's labour theory of value was employed to do. (Meek 1977, 133)

After a period of dormancy, this sympathetic view of Sraffa's theory of price has been revived by a number of Marxists, most notably those belonging to the so-called New Interpretation (NI) of Marx's theory of price. One of these is Riccardo Bellofiore, who has written extensively on what he perceives to be the relation of Sraffa's work to that of Marx's. On the basis of his own readings of Sraffa's unpublished notes and correspondences, Bellofiore (2012) argues that

Sraffa was not fundamentally opposed to the labor theory of value. Rather, as for the NI, he was allegedly only opposed to it as an explanation of individual prices. Indeed, for Bellofiore, Sraffa's work reinstates the soundness of certain aspects of Marx's theory of value in a manner akin to the NI, namely, the identity between new value added by living labor and the price of the net product (Bellofiore 2012). From what I have to say below, it should become clear that while there are good reasons for Marxists to be sympathetic to the work of Sraffa, it is certainly not because it helps overcome any alleged logical problems with Marx's transformation procedure.[4]

Other Marxists, as well as non-Marxists, have claimed that the essence of Sraffa's work was inspired by his reading of Marx. De Vivo (2003) and Gilibert (2003), e.g., suggest that Sraffa's equations in his *PCMC* were inspired by his reading of Marx's reproduction schema in the second volume of *Capital*. Although Sraffians such as Kurz (2012) deny this, it seems more than likely that there is something of an element of truth in the claims of De Vivo and Gilibert.

Critical Views

The major criticism of Sraffa's theory of price by Marxists has, not unexpectedly, been that it eliminates value, in the sense of the labor time required for the production of the commodity, from the explanation of its price (see, e.g., Roosevelt 1977; Sen 1978; Shaikh 1981; Fine 1982). As a consequence, what Sraffa is seen as providing is more a method of calculating prices than explaining them (see Sen 1978; Fine 1986). In my view, Sraffa does not actually deny "value" as something separate from price nor does he reject the notion that the relative magnitude of value determines the relative magnitude of price. Indeed, notwithstanding the fact that he appears to equate value with price in his *PCMC* (see Sraffa 1960, 9), it is readily apparent that he consistently adheres to the view that commodities possess an intrinsic worth which is distinct from their exchangeable worth or prices. This intrinsic worth or value Sraffa takes to be the relative quantities of direct and indirect commodity inputs required for the production of the commodity as an output (see also Bellofiore 2008; 2012; Porta 2012).

In fact, as I noted earlier, it is this fundamental argument that Sraffa seeks to establish at the very outset of *PCMC* when analyzing prices in the context of a subsistence economy setting, and which he repeatedly comes back to when he develops this analysis in a surplus economy setting, even though he was fully aware that in such a setting the magnitude of price could no longer be argued to equal the direct and indirect commodities required to produce the commodity (i.e., its value) because of the existence of profit. As I also noted above, the way Sraffa seeks to develop this fundamental argument in a surplus product economic setting is by reference to changes in prices in the context of changes in both methods of production and the rate of profit. Specifically, he attempts to show with the aid of a layering of commodity inputs that unlike changes in the methods of production, changes in the rate of profit have no determinate impact on prices.[5] Hence, value, or rather Sraffa's understanding of it, continues to be the primary determinant of price. The analogy with Marx's theory of price in a capitalist economic setting should be only too apparent. For Marx (1981) too, although the magnitudes of prices of commodities can no longer be argued to be equal to the relative labor time required to produce them in a competitive capitalist economic setting where producers appropriate a rate of profit which is commensurate with the economy-wide average rate, relative labor time can still be argued to fundamentally determine the magnitudes of prices as manifest ". . . in the influence of the changing productivity of labor on the rise and fall of prices of production . . ." (967; emphasis added).[6] For Marx (1981), however, it is not that changes in the rate of profit have no determinate impact on relative prices, but rather that this impact, which is most certainly determinate, is relatively muted in comparison with changes in the relative labor time required for the production of commodities, i.e., the values of commodities (265–66).[7]

If the problem with Sraffa's explanation of price is not the absence of a concept of value, what is it? Quite simply, it is Sraffa's concept of value itself, or rather its lack of measurability. Sraffa sees value (in the sense of the commodity inputs required for the production of a commodity) as existing and determining price but denies that it is measurable independently of price. This is because he denies that the relative quantities of commodity inputs can be measured independently of, and prior to, the determination of the prices of outputs they help produce, including their own prices as outputs (see Sraffa 1960, 9). While one can accept that the values (intrinsic relative worth) of produced inputs are not formed prior to, and independently of, the formation of their own prices as well as those of the outputs they are used to produce, if the values, i.e., relative quantities, of these inputs are argued as determining the relative prices of commodities in more than a metaphysical way they should most certainly be seen as measureable independently of price. Otherwise, the concept of value as understood by Sraffa—relative quantities of inputs—as an explanation of price is surely meaningless. Without a measure of the physical quantity of inputs other than price, it is surely meaningless to argue, as Sraffa does, that a change in the methods of production (e.g., an improvement) can be expected to have a determinate impact on the relative prices of outputs (i.e., a fall in the relative prices of commodities produced with these inputs) since it would be difficult to establish a priori what an improvement in the methods of production means given that they typically comprise a large array of produced inputs.

It is no doubt this lacuna in Sraffa's theory of price that results in it being in the final instance a vacuous explanation of price, and seen by its critics as little more than a method of calculating prices. It represents a problematic explanation of the prices of commodity outputs, in that these prices are seen as determined by the prices (and quantities) of commodity inputs (and distribution of income), and the prices of the latter (commodity inputs or basics) by the technical conditions of producing the inputs or basics by means of themselves. Aside from the dubious nature of the distinction between basics and non-basics,[8] the question arises as to the meaning to be accorded to the production of inputs by means of themselves. To overcome the obvious problem of the heterogeneity of basic inputs, Sraffa invokes the artificial constructs of the standard industry and standard commodity, which essentially reduces basic inputs to a single input (see Fine 1982). But even accepting this reduction, one has to ask how meaningful it is to explain the magnitude of the price of an input by the method of producing it in terms of itself. The problematic nature of such an explanation becomes particularly evident when considering changes in the magnitude of the price of the input in question since the implication is that a change in the relative price of the input in question is to be explained by a corresponding change in the productivity of that input in terms of itself. For example, if oil is assumed to be the basic input in question, a fall in the relative price of oil is to be explained by a rise in the productivity of oil in terms of itself.

It is also no doubt this lacuna in Sraffa's theory of price that also causes him to vacillate between a commodities required and commodities commanded explanation of price. Thus, having argued that if an invention were to reduce the required commodity inputs by half, it would cause the price of the commodity produced with these inputs to fall (Sraffa 1960, 7–8); Sraffa then does something of an about-face and argues that the prices of non-basics "are merely a reflection of what must be paid for means of production, labor and profits in order to produce them" (8). And it is this commodities commanded version of Sraffa's theory of price, which is perhaps the most common interpretation of it by his supporters and critics alike, that is most vulnerable to the criticism of being little more than a (adding-up) method of calculating price.[9]

A second related Marxist criticism of Sraffa's theory of price is that he eliminates surplus value (defined as the excess of labor time expended by labor over and above that needed to reproduce wage goods), from his explanation of profit, thereby reducing this explanation to one of the physical productivity of commodity inputs (see, e.g., Shaikh 1981). I would argue, along similar lines to what I have argued above, that Sraffa does in fact have a concept of surplus value or surplus worth which is analogous to his concept of value and, unlike the latter, he sees it as measurable independently of price. The problem in this case is how he conceives of the magnitude of surplus value or profit as being measurable independently of price. The starting point for this conception in Sraffa's work is his view that the net product comprises both the wage and the profit. In the standard system, which is a sub-system of the actual system and therefore a reflection of the latter, the net product is argued to be comparable to the means of production without recourse to prices since they comprise the same goods in the same ratios to one another as both inputs and outputs. Hence, the profit component of the net product (like the wage component) can be measured without recourse to prices. However, as many Marxists and non-Marxists have pointed out, the net product and means of production can only be deemed to be comparable with one another because of the artificial standard system construct, i.e., the fixed ratios between inputs and outputs (see Robinson 1961; Fine 1982). This construct effectively makes the commodities comprising both the net product and inputs in the standard system a single product. In other words, Sraffa does away with the need to measure the physical quantity of commodities comprising the surplus product independently of price by assuming the standard system in effect comprises only one commodity.

Sraffa's problematic explanation of profit in terms of the productivity of physical inputs becomes particularly evident when, as Sraffa admits is more the usual practice (see Sraffa 1960, 9–10), inputs are taken to include wage goods. Leaving aside the problem of having to distinguish between wage goods which constitute basics and those which constitute luxuries, the "productivity" of the former can only be meaningfully understood as labor producing more commodities than is required for its own subsistence.[10]

A third Marxist criticism of Sraffa's theory of price, one which has received significantly less attention than those noted above, is that he takes the rate of profit as given from outside of the system and independent of prices (see Guillén Romero 1984). Marxists have argued that the rate of profit needs to be understood as being formed in the process of the formation of prices and not independently of this process. I might add that in fact Sraffa's own analysis suggests the rate of profit is formed in the context of the formation of prices as a result of the transfer of value between sectors. Thus, Sraffa notes that a fall in the wage share would cause relative prices in sectors with lower-than-average proportions of labor to means of production to rise, and fall in sectors where the proportion of labor to means of production is higher than the average. Since Sraffa assumes that there is no change in either the aggregate surplus product or ratio of surplus product to means of production in each sector, it must mean that the resulting economy-wide rate of profit, whatever it happens to be, is formed and reformed in the process of the formation of the prices of production as a result of a transfer in worth between the sectors, i.e., command over productive resources.

A fourth criticism of Sraffa's theory of price is that he introduces an arbitrarily chosen or constructed commodity into the economic system to reduce prices to equivalence (see, e.g., Fine 1982; Giussani 1984). Although Marxists have not been clear on this issue, the question which needs asking of Sraffa's analysis in this regard is why and how an arbitrarily chosen commodity, let alone an artificially constructed commodity, can be seen as reducing the relative exchangeable worth of commodities to equivalence. On the question of why, Sraffa appears to suggest that the *numéraire* can be seen as reducing commodities to equivalence because it is a common input for all of them. But, if this is indeed how he sees the *numéraire*, it would suggest that for him commodities are deemed to acquire comparable exchangeable worth only once they all come to be produced by a certain commodity input—the commodity input that serves as *numéraire*. Moreover, while one could plausibly see the *numéraire* as a produced commodity input, it is difficult to know what to make of an artificially constructed commodity. On the question of how the *numéraire* can be seen as reducing the relative prices of commodities to equivalence, it could be argued that the logic of Sraffa's analysis suggests it is when all producers use it, the *numéraire* commodity, to measure the worth of their individual commodities. But this begs the question why producers would use something other than money for this purpose. While the *numéraire* could plausibly be seen as performing the function of money in this sense, the artificially constructed standard commodity cannot.

This leads to the fifth and final Marxist criticism of Sraffa's theory of price, and another that has been relatively neglected: that it abstracts, in the sense of ignoring, money and therefore provides no real basis for the explanation of money prices—something Sraffians readily agree with (see, e.g., Hodgson 1981; 1982). I would argue, however, that while Sraffa's theory of price quite patently ignores money, it does nevertheless have certain implications for an understanding of money and money prices, but that most of these are problematic. One implication is that money is the *numéraire*. This immediately raises the question of how an artificially constructed composite of commodities, or even an arbitrarily chosen commodity, can be regarded as money. Money emerges as something, typically a commodity, which all other commodities express their exchangeable worth in. It is not just any commodity, not even any commodity input, and certainly not an artificially constructed composite of commodity inputs. It also raises the question of how we are to understand the value of money and, therefore, the level of money prices if money is taken to be the *numéraire*. As a *numéraire*, money is necessarily a particular commodity in the Sraffian system, and as a particular commodity its (relative) exchange value is necessarily given by the relative direct and indirect commodity inputs required for its production and commanded by profits (see, e.g., Steedman 1977). However, if, as Marx argued, money is not just any commodity input but the general commodity or universal equivalent, its value should logically be given by the average values of all of the commodities it exchanges with. For the average values of commodities to be reflected in the money commodity, these values should be reducible to equivalence in the first place. In the Sraffian system, it is only the *numéraire* that reduces them to equivalence.

Parenthetically, it needs noting that Sraffa's problematic understanding of money and the determination of its value is evidenced by his perceived need for an invariable standard whose price should not itself be subject to variation as a result of a change in the wage share. What Sraffa appears to overlook in this regard is that the invariable standard he is searching for is none other than money since whatever impact a change in the wage share might have on relative prices, these will remain the same when expressed in terms of money. They will remain the same when expressed in terms of money because, as Marx (1969b) pointed out in his criticism of Ricardo's quest for an invariable standard, the value of money and the general equivalent is given by the average value of all the commodities it exchanges with and not its relative worth as a particular commodity (200).

If money is not the *numéraire*, then it can only be the standard of the *numéraire* since money and the *numéraire* cannot both be the measures of exchangeable worth of commodities. But what meaning can be attached to money as the standard of an input into production, let alone a standard of an artificially constructed commodity? And, concomitantly, what sense can be made of the value of money and money price level as given by the quantitative relation between money and a particular commodity input (say oil), let alone money and the standard commodity?

The Source of the Problems in Sraffa's Theory of Price

Most of the preceding problems with Sraffa's theory of price identified by Marxists can be argued to stem from his focus on the determinants of the magnitude of price and his resulting failure to consider how prices come to be formed. It is this failure that causes, if not actually allows, Sraffa to eliminate labor, and ignore both money and the process of competition, in his explanation of prices.

I begin with the elimination of labor. Since Sraffa does not analyze how prices are formed, he loses sight of the fact that they emerge historically when the economic system comes to be founded on a division of labor mediated by exchange. When human beings cooperate with one another in the production of goods, commodities begin to acquire worth or value in relation to one another which necessarily reflects the labor time required for their production. When exchange mediates the division of labor, the exchangeable worth of commodities reflects this intrinsic worth. As Marx argued, the essence of socially based production is the allocation of labor time. It is human beings who produce commodities, albeit with the aid of commodities. Commodities do not produce commodities. Commodities would have no value or price if labor were not required for their production. The same cannot be said for commodities, i.e., commodities would have no value or price if other commodities were not required for their production.

Sraffa's focus on the determinants of the magnitudes of relative prices also allows him to abstract from, in the sense of ignoring, money. Abstracting from money permits him to choose, or construct, a *numéraire* commodity which reduces the exchange ratios between commodities to equivalence without, as argued above, having to worry about the hows and whys of this reduction and the link between the *numéraire* and money. If Sraffa had considered how money emerges, he could not have escaped the conclusion that it, and not an arbitrarily chosen or constructed commodity, emerges as the measure of exchangeable worth whose own worth is given by the worth of commodities it exchanges with and not the physical requirements of its production. Of course, even if he had conceived of money as the general equivalent in this manner, he would have had to overcome the problem of explaining the exchangeable worth of commodities without reducing them to equivalence independently of price.

And, finally, Sraffa's failure to analyze how prices come to be formed in the specific setting of a surplus economy causes, or rather allows, him to ignore how competition gives rise to standard prices for standard commodities and the appropriation of an average rate of profit by the average producer in a given sector. Hence, instead of explaining how standard prices come to be formed by intra-industry competition, Sraffa (1960) simply assumes that a determinate set of prices exists where the number of commodities equals the number of production processes (4–5). Apart from the questionable real-world validity of this assumption, it requires Sraffa to make other increasingly unrealistic and counter-intuitive assumptions in the course of his analysis of the determinants of the magnitudes of prices in a surplus product economic setting. For example, in a joint-product setting, where more than one product is produced by any given production process (e.g., wheat and straw or wool and mutton), it requires Sraffa to assume that a given product is produced by more than one method of production. In fact, it requires Sraffa to assume the same number of methods of production as joint commodities produced, without any explanation as to the intuitive logic behind the assumption—how and why the same commodity produced with different techniques would give rise to a single price. When Sraffa takes into account the existence of fixed capital, this failure to analyze how prices are formed causes, or allows, him to assume fixed capital of all ages and degrees of wear and tear are produced commodities having prices even though they are neither produced nor marketed, except in limited numbers of instances. Obviously, without such an assumption, his "explanation" of prices in terms of commodity inputs would break down. And, when he takes into consideration scarce non-produced inputs of a similar quality, Sraffa indicates that it is possible for there to be more than one production process but argues that for a single price and equalized rate of profit to prevail, the more efficient technique also needs to be the higher cost technique.

Moreover, as noted above, instead of explaining how an average rate of profit comes to be formed as a result of competition between firms in different sectors, he assumes it to be given from outside of the system by "the level of the money rates of interest" (Sraffa 1960, 33). As also noted above, if Sraffa had explained how the average rate of profit comes to be formed and reformed in the context of inter-industry competition, he would have had to reduce the commodity components of the surplus product to equivalence—something that is not possible in the absence of a measureable concept of value unless one assumes that all commodities are reducible to one and the same commodity.

Concluding Remarks

From the preceding, it could be concluded that what Sraffa bequeaths economics in terms of the theory of price is merely a method for calculating (equilibrium) prices. But this epitaph would be excessively harsh. My own view is that his major positive contribution to the theory of price is to shift the focus of the explanation of price back to a real cost explanation in the manner of Marx (and Ricardo). As I have argued above, there are clear parallels between his and Marx's explanation of the magnitudes of relative prices and changes in these in terms of the emphasis they both place on the magnitudes of required direct and indirect physical inputs and productivity changes in respect of these. The problem, as I have also argued, is that the path Sraffa chooses for his own real cost explanation leads essentially to a dead end. Specifically, his denial that value can be measured independently of price causes him to have a problematic explanation of price and a distorted conceptualization of money.

Reading Sraffa's *PCMC*, as well as various interpretations and attempted developments of this work by those sympathetic to it, one cannot help feeling that at least part of the blame for Sraffa's mistaken path is his concern to provide mathematical rigor in his arguments. It is this concern that at least in part leads Sraffa to focus on the determination of the magnitude of price rather than its formation, and it is this focus in turn that allows and even necessitates him to adopt so many dubious assumptions and constructs in the course of his analysis. It is also this focus that leads, and has led, so many of his followers to pursue what are largely barren mathematical exercises masquerading as analytical rigour.[11]

Notes

1. In their introduction to a collection of articles on the work of Sraffa presented at a conference to mark the 50th anniversary of the publication of *PCMC*, Blankenburg, Arena, and Wilkinson (2012; 1270) note that although a number of Sraffians see the primary focus of Sraffa's work to be the study of the "surplus product" and its distribution, they are of the view that the majority see this focus to be the theory of price.
2. The interested reader is referred to Nicholas (2011, chapter 8) for a critical assessment of these extensions of Sraffa's theory of price.
3. See also Dobb (1970) and Medio (1977).
4. For critical reviews of those traditional interpretations and New Interpretations (NIs) of Marx's theory of price which see it as logically flawed (see Nicholas 2011, chapter 4).
5. Sraffa's unpublished articles suggest that in the early stages of the development of his ideas, before settling on the idea of showing the indeterminate impact of changes in the rate of profit on prices, he even toyed with conceptualizing profit (which he equated with interest) as "necessary" to keep capitalists invested (see Kurz 2012; 1550). This would have allowed him to retain the argument that the magnitudes of relative prices of commodities are determined by the relative magnitudes of value of the relative inputs required for their production. Although it is not clear why he abandoned this line of argumentation, one may surmise that he did so because he realized it would be tantamount to endorsing the Neoclassical explanation of profit.
6. It is perhaps his recognition of the obvious parallels between his own theory of price and that of Marx's that explains his defense of Marx in respect of Borkiewicz's criticism of Marx's transformation procedure, arguing that Marx's solution was "approximately" correct (see Sraffa 1960).
7. It warrants noting that Marx denied it is meaningful to layer inputs *ad infinitum* when computing costs of production since to do so would imply, on the one hand, costs were essentially embodied not required costs and, on the other hand, what was paid for these inputs did not represent the latter, i.e., the required costs (see Marx 1969a, 100–102; 1976, 293–95).
8. See Nicholas (2011, 146) for an elaboration of this point.
9. Interestingly, it is a similar interpretation of Marx's theory of price, i.e., as a labor commanded theory, that makes it (Marx's theory) vulnerable to the Sraffian charge of redundancy. Specifically, Sraffians have, with some considerable justification, argued that knowledge of the labor commanded by the commodity inputs, wage, and profit presupposes a prior knowledge of the technical conditions of production (i.e., the required inputs) and the distribution of income (see, e.g., Steedman 1977; Roncaglia 2009; Sinha 2010).
10. Many Marxists have also questioned Sraffa's and Sraffian contentions that (given the technologically determined magnitude of the surplus product) the magnitude of profit is explained by the distributional struggle between labor and capital over the surplus product, arguing that a characteristic feature of capitalism is the wage is advanced before production, including the production of the surplus product (see Rowthorn [1974] for an early example of this line of Marxist argumentation).
11. In this context, I am reminded of Tony Lawson's repeated warnings against the excessive emphasis placed in economic analyses on forms of mathematical deductivist reasoning (see Lawson 1997; 2003; 2012).

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