A Reinterpretation of Sraffa's *Production of Commodities*
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1. Introduction

In Sraffa's equations, the sectoral rate of profits is always taken to be equal. As a matter of fact, Sraffa claims that it *must* be uniform:

> [T]he surplus (or profit) *must* be distributed in proportion to the means of production (or capital) advanced in each industry; and such a proportion between two aggregates of heterogeneous goods (in other words, the rate of profits) cannot be determined before we know the prices of the goods. … Accordingly we add the rate of profits (which *must* be uniform for all the industries) as an unknown … (Sraffa 1960, p. 6, my emphasis).

The received interpretation of this condition is that Sraffa *implicitly* assumes his system to be at the classical centre of gravitation. I find this interpretation unconvincing. There are several *prima facie* reasons to dispute this:

(1) On page 22 of the book, Sraffa clearly states:

> Such a relation is of interest only if it can be shown that its application is not limited to the imaginary Standard system but is capable of being extended to the *actual economic system of observation.* (Sraffa 1960, p. 22, my emphasis).

Thus it is clear that he deals with an observed actual system and not an *ideal* system that is supposed to exist at the classical centre of gravitation or equilibrium.

(2) The classical notion of centre of gravitation equilibrates supplies with effectual demands and the process implicitly assumes constant returns to scale. Sraffa in the very first sentences of the 'Preface' warns the reader not to think in those terms when it comes to his propositions:

> Anyone accustomed to think in terms of the equilibrium of demand and supply may be inclined, on reading these pages, to suppose that the argument rests on a tacit assumption of constant returns in all industries. … In fact, however, no such assumption is made. (Sraffa 1960, p. v).

(3) In the Appendix B of the book, Sraffa discusses a case of a non-basic good, 'beans', which uses a very large proportion of itself in its production, implying that it's rate of profit cannot exceed the ratio of its own net output to its input. Sraffa discusses the problem with the assumption of positive prices for all goods in this case when the rate of profits of the basic goods sector is higher than the one the beans can admit. This problem, however, cannot arise if the system was assumed to be at the

centre of gravitation, as the gravitation mechanism would ensure that the bean sector disappears in the process.

(4) In a note after the publication of the *Production of Commodities*, Sraffa wrote:

> The wage and the aggregate profit of reality are, at best, rough approximations of the standard wage and profit. *But the rate of profit of reality is identical to that of the standard.* (D3/12/111/139, the English translation from the original in Italian is quoted in Gehrke 2007, my emphasis).

As a matter of fact, during the period of his early theoretical breakthrough, i.e., from late 1927 to 1931 (see Garegnani, 2005), we find that Sraffa was worried about how to "justify or explain the equal percentage added to initial stock of each industry." And after arguing that capital might not be reinvested in the sectors having lower rate of profits and thus not being able to reproduce itself in the long run, he goes on to add, "in this way *we are allowing to come back through the window the [notion of cost as] 'inducement' we had excluded from the door* [PSP D3/12/6]" (quoted in Garegnani 2005, p. 475, my emphasis). During the same period, we find him writing in another note: "I must find a 'force' capable of obliging those people in the market to actuate my equations" (D3/12/7/107-14,). [1] It should be noted that Sraffa had taken a philosophical or methodological position that the theoretical understanding must be built on only things that are ideally *observable* and thus no subjective element (such as "inducement") should enter his equations. Furthermore, during the same period, Sraffa in an attempt to explain the meaning of his equations wrote, "The significance of the equations is simply this: that if a man fell from the moon on the earth, and noted the amount of things consumed in each factory [...] during a year he could deduce at which values the commodities must be sold, *if* the rate of interest must be uniform and the process of production repeated. In short, the equations show that the conditions of exchange are entirely determined by the conditions of production." (PSP, D3/12/7, my emphasis). The reader should take note of the qualifier, "*if* the rate of interest must be uniform". Interestingly, the qualifier "if" disappears from the relevant passage in the book! So the question is: what could have happened between the early breakthrough and the publication of the book in 1960? Clearly at this stage Sraffa is conscious of the fact that he needs to "justify" uniformity of the rate of profits in his system of equations and that the classical centre of gravitation is not an obvious explanation that he can use. (For a more detailed criticism of the received interpretation, see Sinha and Dupertuis 2009a).

Given that there is strong prima facie reason to reject the received interpretation, below in section 2, I provide an alternative argument to justify Sraffa's claim that the rate of profits must be uniform irrespective of the condition of the classical centre of gravitation. In section 3, I present some evidence from Sraffa's writings (both published and unpublished) that show that Sraffa reasoned in similar manner. In the end, in section 4, I take up the evidence provided in support of the received interpretation to show that they do not stand up to critical scrutiny.

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[1] I am obliged to Nerio Naldi for the English translation of the original in Italian, "devo trovare una <<forza>> che costringa quella brava gente sul mercato a realizzare le mie equazioni."

2. Why the rate of profits must be uniform?

Let us take Sraffa's simple example of the two-good subsistence economy:

280 qr. wheat + 12 t. iron → 400 qr. wheat
120 qr. wheat + 8 t. iron → 20 t. iron

It is clear that this system is in self-replacing state and the exchange ratio between iron and wheat must be 10 qr. of wheat for 1 t. of iron. In this case, the price ratio of the two commodities spring directly from the conditions of production. Now, let us take an empirical system of production that has produced surplus:

90t. iron + 120t. coal + 60qr. wheat + 3/16 labour → 180t. iron
50t. iron + 125t. coal + 150qr. wheat + 5/16 labour → 450t. coal   **I**
40t. iron + 40t. coal + 200qr. wheat + 8/16 labour → 480qr. wheat
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180t. iron + 285t. coal + 410qr. wheat + 1 labour → 180t. iron + 450t. coal + 480t.
                                                                                                wheat

And in terms of its price equations the system is represented by:

$(90P_i + 120P_c + 60P_w)(1+R_i) + 3/16\ \omega = 180P_i$
$(50P_i + 125P_c + 150P_w)(1+R_c) + 5/16\ \omega = 450P_c$ **I'**
$(40P_i + 40P_c + 200P_w)(1+R_w) + 8/16\ \omega = 480P_w$
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$(180P_i + 285P_c + 410P_w)(1+R) + \omega = 180P_i + 450P_c + 480P_w$

In this system, prices cannot be determined unless the rule for distribution of the surplus is known. Sraffa asserts that the sectoral rates of profits *must* be uniform. If that is so then given wages, the two relative prices and the uniform rate of profits of the system could be simultaneously determined. It has been almost universally interpreted that Sraffa's claim that the rate of profits must be uniform is an admittance of the competitive equilibrium condition or the condition of the centre of gravitation (see John Hicks for an exception)[2]. Without going into exegetical arguments that Sraffa did not think in terms of equilibrium of demand and supply, let me here motivate a logical argument behind the condition of

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[2] "Sraffa leaves us to find out what his prices are, but I doubt if they are equilibrium prices. They seem to be prices which are set upon products, by their producers, according to some rule. Now it is perfectly true that we are nowadays familiar with that method of price-fixing, by 'mark-up'; but when that method is used, the rate of profit that is used to establish the mark-up is conventional. Now it may be that Sraffa wants us to think of his rate of profit as being conventional; and that the uniformity of the rate of profit throughout his system, of which he makes so much, is just a uniformity of convention" Hicks (1985, p. 306).

the uniformity of the rate of profits independently of the notion of equilibrium of demand and supply.

The problem that Sraffa is posing is this: System-I produces a surplus or a net output equal to (165t. coal + 70t. wheat). This net output is distributed between the capitalists and the workers. In what proportion the net output is distributed between the two classes cannot be known unless the net output, which is given in terms of heterogeneous goods, is homogenised by their prices. However, prices *must* be such that the value of the net output remains constant when it is distributed to the two classes in any proportions. In other words, a set of prices homogenises a collection of heterogeneous goods into a homogeneous cake; however, a logical requirement of any set of prices is that it must maintain the size of the cake constant when it is cut in different proportions. Below we present two separate arguments that show that given that distribution of income is taken to be given from outside and the wages are taken to be uniform, or the heterogeneous labour is homogenised by the given wage differentials, as in Sraffa's examples, then a logical corollary of it is that prices must be such that all sectoral rates of profits *must* be equal.

Let us assume an imaginary system given by:

120t. iron + 160t. coal + 80qr. wheat + 1/4 labour → 240t. iron
40t. iron + 100t. coal + 120qr. wheat + 1/4 labour → 360t. coal   **II**
40t. iron +   40t. coal + 200qr. wheat + 2/4 labour → 480qr. wheat
_____
200t. iron + 300t.coal + 400qr. wheat + 1 labour → 240t. iron + 360t. coal + 480t. wheat

And in terms of its price equations, the system is represented by:

$(120P_i + 160P_c + 80P_w)(1+R_i) + 1/4\,\omega = 240P_i$
$(40P_i + 100P_c + 120P_w)(1+R_c) + 1/4\,\omega = 360P_c$ **II'**
$(40P_i + 40P_c + 200P_w)(1+R_w) + 2/4\,\omega = 480P_w$

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$(200P_i + 300P_c + 400P_w)(1+R^*) + \omega = 240P_i + 360P_c + 480P_w$

System-II is nothing but Sraffa's Standard system to the given empirical system-I. It redistributes the total labour of the system or rescales the real system in such a way that the aggregates of its inputs and outputs come out in the same proportions. Let us assume that wages are zero, then in the above given example of system-II, it is clear that the rate of profit of the system as a whole, i.e., R^* is equal to 1/5 or 20%. This is because in this case the ratio of the aggregate physical net output to the physical aggregate inputs can be known without the knowledge of prices since it is a ratio of heterogeneous goods made up in the same proportion. This ratio is completely independent of prices—no matter what prices prevail, it will not affect the global rate of profit (i.e., R^*) of the *Standard system*. But the empirical system-I is nothing but an equivalent system to the Standard system-II, since the total labour used in the two systems as well as the techniques used

are the same. Thus the rate of maximum possible expansion or growth of the two systems must be the same. In other words, R must be equal to R* and this condition must hold for all possible rescaled systems of the Standard system. However, this condition can hold if and only if all the sectoral rates of profits must be uniform or equal. From here it is a small step to show that this condition must hold for any positive wages, as long as wages are given and measured in Standard commodity, which is a composite commodity made up of all the basic goods in Standard proportion.[3] The point can also be illustrated in another manner.

Let us take the real system-I and assume that the rate of profits is equal in all the sectors. In this case, given wages we can solve for a set of prices and the rate of profits of the system measured by any arbitrary *numéraire*. Now, if we change the wages (say from zero to its maximum value) all the prices must change to ensure the equality of the rate of profits, since the ratio of means of production to labour in all the sectors are unequal. It is well known that the relationship between the wages and the rate of profits so derived would be a non-linear inverse relation (Sraffa 1960). The non-linearity of this relation implies that the size of the total net output measured by the *numéraire* changes as the distribution of the given net output changes. This happens because the size of the *numéraire* or the measuring rod itself is affected by the changes in distribution. Sraffa argues that if the Standard commodity is used as the *numéraire* it can be shown that the relationship between wages and the rate of profits would be linear, which is given by $r = R(1 - w)$, where r is the uniform rate of profits in the system, R is the maximum rate of profits of the system and w is the wage rate measured in the Standard commodity. In other words, the Standard commodity is not affected by the changes in distribution of the given net income.[4] Now, for our argument, let us begin with zero wages and equal rate of profits and a set of prices measured in the Standard commodity. Then we give some positive wages in terms of the Standard commodity, if we keep the old prices then it must generate unequal rates of profits in all the sectors as the ratios of means of production to labour in all the sectors are unequal. These unequal rates of profits would most likely generate a global rate of profit (i.e., R, the weighted average rate of profit for the aggregate of all the sectors) for system-I that will fall off the earlier straight line relation between wages and the rate of profits drawn on the condition that the rates of profits are equal throughout. As a matter of fact, if we keep the old prices constant and go on increasing the wage from zero to its maximum value, we would trace out a non-linear relationship between wages and the global rates of profit, which may cut the earlier straight line relation a few times (see the diagram below). This is a general case for all sets of prices that generate unequal sectoral rates of profits in the system. However, the non-linear relation between wages and the global rates of profits generated by those prices implies that accounting of the total net income by such prices is inconsistent, since the size of the pie cannot change simply by cutting it in different proportions. Hence it is a logical property for any given system of production that its prices should be such that the sectoral rates of profits of the system are equal. This proves that the solution of a set

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[3] A basic good is a good that inters directly or indirectly as input in the production of all the commodities, whereas a non-basic good does not inter directly or indirectly in the production of any basic good, though it could inter as input in the production of the subset of non-basic goods.

[4] Baldone (2006) has confirmed that Sraffa's Standard commodity makes the *numéraire* effect null.

of prices does not need any notion of equilibrium. Prices of any given system of production and distribution can be determined by the given objective data of its inputs and outputs along with the knowledge of the wage rate or the rate of profits of the system. Prices have a job to do and their job is to consistently account for the *given* distribution of the net income between the two classes. Once it is taken that labour is homogenised by the given wage differentials that are given from outside the system, a logical corollary of it is that the remaining income must be distributed to the capitalists in equal proportion to their size of capital.

Wage-Profit Relation
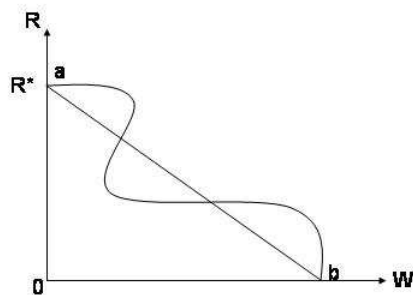
3. Evidence from Sraffa's Writings

Below I produce some evidence from Sraffa's writings that seem to support our argument presented above. In the *Production of Commodities*, Sraffa seems to be arguing in a similar manner when he declares that the mathematical property of the rate of profit of the Standard system commutes to the real system:

> But the actual system consists of the same basic equations as the Standard system, only in different proportions; so that, once the wage is given, the rate of profits is determined for both systems regardless of the proportions of the equations in either of them. Particular proportions, such as the Standard ones, may give transparency to a system and render visible what was hidden, but they cannot alter its mathematical properties (Sraffa 1960, p. 23).

The reader should note that the classical condition of supplies equal to the effectual demands cannot be a 'mathematical property' of the system. It should also be noted that Sraffa could not implicitly assume that supplies were equal to their effectual demands for both the real and the Standard systems—it would be bizarre to assume that the effectual demands were in Standard proportion even in an imaginary world. Thus Sraffa could not

impose the condition of a uniform rate of profits on his Standard system on the basis of the so-called implicit assumption that the system is at its centre of gravitation. Hence the rate of profit of the Standard system that Sraffa is referring to above is the *global rate of profit* of the Standard system and the claim is that the two *global rates* must always be equal as long as the wages are measured in the Standard commodity. It is the proposition regarding the equality of the *global* rates of profit of the rescaled systems that allows Sraffa to directly deduce that all the sectoral or industrial rates of profits *must* also be uniform in the two systems, as we have argued above. This point becomes clearer in the very next paragraph from the above quoted passage:

> The straight-line relation between the wage and the rate of profits will therefore hold in all cases, provided only that the wage is expressed in terms of the Standard product. The same rate of profits, which in the Standard system is obtained as a ratio between *quantities* of commodities, will in the actual system result from the ratio of aggregate *values*. (Sraffa 1960, p. 23, emphasis in original).

The reader should note that both the ratios of "quantities of commodities" and of "aggregate values" are well defined only at the *global* level and has no meaning at the local or industrial level.

Further on, in his unpublished notes written in 1955, we find that Sraffa invokes similar reasoning behind the possibility of an existence of a Standard commodity:

> With changes in w --
> The impulse towards price change is an internal one to each industry. It arises from its own internal conditions—not from those conditions compared with those of other industries. Hence the possibility of an invariable commodity. (Sraffa N.D., D3/12/59, underline in original).

Recall the discussion on the Standard commodity in Sraffa (1960). He starts with zero profits and all income going to wages. Then wages are reduced by a certain percentage. Sraffa's argument is that this gives rise to a positive global rate of profit and all the sectoral rates of profit equal to it. Given that all the rates of profit must be equal, the old prices applied to the goods create surpluses and deficits in the sectors given their different proportions of labour and means of production. And it is these surpluses and deficits that force the sectors to adjust their prices. That is why a sector which will not have any surplus or deficit will have no compulsion to change its price and hence the possibility of an 'invariable commodity'. If one allows the gravitation mechanism to explain the equality of the rate of profits in the system then no commodity could stay invariant. The difference between the two approaches is this: In Sraffa's case, the condition of equal rate of profits is given or must be applied on the system in all the circumstances and prices change as a *consequence* of this condition. Hence the idea of change based on *comparison* with other industries is categorically denied. In the classical case, on the other hand, the rates of profit eventually become equal as a *consequence* of changes in prices, which are explained precisely in terms of *comparison* with other industries.

In fact such reasoning was foreshadowed in the earlier chapter on 'Proportions of Labour to Means of Production', where Sraffa explained:

> For the same reason it is impossible for prices to remain unchanged when there is inequality of 'proportions'. Suppose that prices *did* remain unchanged when the wage was reduced and a rate of profits emerged. Since in any one industry what was saved by the wage-reduction would depend on the number of men employed, while what was needed for paying profits at a uniform rate would depend on the aggregate value of the means of production used, industries with a sufficiently low proportion of labour to means of production would have a deficit, while industries with a sufficiently high proportion would have a surplus, on their payments for wages and profits. (Nothing is assumed at the moment as to what rate of profits corresponds to what wage reduction; all that is required at this stage is that there should be a uniform wage and a uniform rate of profits throughout the system.) (Sraffa 1960, p. 13, emphasis in original).

The reader should note that instead of arguing in the usual manner that if prices "*did* remain unchanged" then it would result in unequal rates of profits across sectors, Sraffa argues in the opposite manner that it would generate 'deficits' and 'surpluses' across the sectors given the *requirement* that "there should be a uniform wage and a uniform rate of profits throughout the system". As a matter of fact, in 1928, when Sraffa had just struck upon his physical quantity equations, he had tried to interpret his equations and the condition of equal rate of profits as the classical/orthodox equilibrium condition without the forces that are supposed to bring the system to equilibrium. In this context, he goes on to argue in the usual manner that non-equilibrium prices would result in unequal rates of profits. But then he realises that his equations would be meaningful only if constant returns are assumed: "Now I am not assuming any forces: I simply say that, if the values will in reality be as given by the equations certain conditions will be satisfied if not they will not be satisfied. In this case, profits will bear different proportions to capital in different industries. Since this happens to a considerable extent in reality, this means that the values in the market will be different from those in the equations. … I am afraid it will be difficult to make it clear that we are considering what has actually happened in the markets, and not what might have happened had things been different. It will therefore be useful to explain that the reader may assume that constant returns prevail" (D3/12/7). A clear shift in Sraffa's position on the condition of uniform rate of profits in his systems of equations is clearly evident here.

Further on, Sraffa in another note of 1955 writes:

> …, the rate of profits at the various individual levels of w̱ will be r = R(1-w). Individual prices will move in all directions with the variation of w̱, but here again prices will make no difference: ṟ is a ratio between two quantities of the same composite commodity and can actually be discovered before knowing what those prices are. The rate of profit is embedded 'in the things' and no manipulation of prices could ever affect it. [There could be no more tangible

evidence of the rate of profits [being, as] a non-price phenomenon (effect)]. (Sraffa N.D., D3/12/53, all underlines, parentheses and brackets are in original).

Yet again it is claimed that the real rate of profits must be identical to the Standard global rate of profit. This finding shows that uniformity of the rate of profits in the system has nothing to do with the equalization of the supplies with their effectual demands.[5] As a matter of fact, relative prices cannot go anywhere they like—they are completely constrained by the system of production and distribution. In some sense Sraffa's result points to a similar break in economics as the break from classical mechanics to quantum mechanics.[6] The classical and neoclassical economics treat individual industries as independent entities, which through their interaction generate centres of gravitation that bring a system into being. Sraffa's result shows that the system is not made up of independent industries but must be treated as an interconnected whole unit and the properties of the whole determine the properties of its parts.

Once the role of prices and the logical condition of the uniformity of the rate of profits in the system is understood, it becomes easy to understand why Sraffa could not have relied on the classical notion of the centre of gravitation. Since in the classical framework the movement of given supplies to their effectual demands must maintain the techniques in use and the total labour in the system constant, all those set of supplies must have the same Standard system (Sinha 2010). Thus for every supply set the solution of its prices must be the same if the wages and the *numéraire* are kept constant. However, the gravitation mechanism requires that every such supply sets throughout its movement *must* have different set of prices. Now the real system can admit of any other set of prices only if the distribution of income is allowed to change. We can work out all the price sets that are compatible with zero to the maximum wages for every supply sets. If the set of the so-called market prices imposed on the system at any given point of time happens to be one of those sets of prices then the system can accommodate those prices by adjusting its wages. But since these market prices must change continuously it is more likely than not that the movement of market-prices will soon fall outside the set of the sets of all compatible prices for the given supply set. And at that stage the system must break down. In the above example we have allowed an arbitrary *numéraire* and the freedom to the system to adjust its income distribution to accommodate a given set of prices. If, however, we use the Standard commodity as the *numéraire* and specify wages in terms of the

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[5] Joan Robinson (1961) had come closest to understanding this as she claimed that the "clue" to understanding the *PCMC* could be found in the 'corn model' of Sraffa's (1951) 'Introduction' to Ricardo's *Principles*. In the 'corn model', e.g. 1 ton of corn produces 1.5 tons of corn; the rate of profit is 50% no matter what is the final demand for corn. This physical relationship between inputs and outputs that is palpably evident in a single basic good model is obscured in n-basic goods model. But Sraffa's analysis with the help of the Standard system reveals that the insight of the corn model remains valid in a more general case as well.

[6] It may be noted that Sraffa was well aware of the developments in quantum mechanics. As early as 1928, he had noted down a passage from H.S. Allen's paper on 'The Quantum Theory' published in *Nature*, where Allen writes, "Heisenberg put forward the demand that only such quantities as are observable should be represented in the mathematical formulation of atomic theory. … This led to the development of the matrix mechanics, every term in a matrix corresponding to something which is, at least ideally, observable." Of course, Sraffa makes the same demand from economic theory.

Standard commodity and keep them fixed throughout the adjustment process, then it is clear that the system cannot accommodate any other set of prices then its initial solution.

All these conclusions must come as a shock to most of the economists. The reason for this is simple. We are habituated to think of prices in terms of sequential time; such as at time t-1 a set of market-prices prevail and on those prices the set of inputs are purchased which in turn produces a set of outputs in time t. In this context the prices of inputs in time t-1 become the cost of production for the prices of outputs in time t. Not only the classical gravitation mechanism is built on this sort of reasoning about prices but even the modern inter-temporal general equilibrium analysis is also based on such reasoning even though it assumes that all present and future markets clear at one point of time. It was on the basis of such reasoning that Frank Hahn (1982) claimed that "It will now be clear that Sraffa is considering a very special state of the economy where … the relative prices of 1976 wheat and barley are the same as those of 1977 wheat and barley. The neoclassical economist is quite happy with more general situation." (pp. 363-64). As a matter of fact a simple observation of Sraffa's Standard system reveals why this way of thinking about prices is flawed (for a detailed criticism of Hahn's paper, see Sinha and Dupertuis 2009b, Sinha 2010). Let us look at the example of Sraffa's Standard system presented above:

120t. iron + 160t. coal + 80qr. wheat + 1/4 labour $\rightarrow$ 240t. iron
40t. iron + 100t. coal + 120qr. wheat + 1/4 labour $\rightarrow$ 360t. coal   **II**
40t. iron +   40t. coal + 200qr. wheat + 2/4 labour $\rightarrow$ 480qr. wheat

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200t. iron + 300t.coal + 400qr. wheat + 1 labour $\rightarrow$ 240t. iron + 360t. coal + 480t. wheat

$(120P_i + 160P_c + 80P_w)(1+R_i) + 1/4\ \omega = 240P_i$
$(40P_i + 100P_c + 120P_w)(1+R_c) + 1/4\ \omega = 360P_c$ **II'**
$(40P_i + 40P_c + 200P_w)(1+R_w) + 2/4\ \omega = 480P_w$

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$(200P_i + 300P_c + 400P_w)(1+R^*) + \omega = 240P_i + 360P_c + 480P_w$

Assuming wages to be zero, it is clear that the maximum rate of profits in this system is equal to 1/5 or 20%. This is a physical property of the system independent of any prices. Any arbitrary set of prices as long as it is applied to both inputs and outputs will leave the maximum rate of profits unchanged. However, if we apply a different set of prices to the inputs and a different set of prices to the outputs as Hahn's "more general situation" warrants, then clearly the maximum rate of profits of the system will, in general, not be equal to 1/5. But this contradicts the physical property of the system. Thus input and output prices cannot be seen in sequential time frame. Prices have only one function in the system and that is to consistently account for the given distribution of income at any point of time. It should be noted that these results are derived on two fundamental assumptions: (1) labour is homogenised by given wage differentials and (2) the share of total income distributed between workers and the capitalists is given from outside the system. Sraffians now need to justify these two assumptions.

4. A Critique of the Evidence Provided by the Received Interpretation

Now let us look critically at the evidence provided in support of the received interpretation that Sraffa's outputs are at the centres of gravitation. We may be asked: if what we say above is true, then what could Sraffa mean by his statement in the 'Preface' where he states: "This standpoint [i.e. of given output], which is that of the old classical economists from Adam Smith to Ricardo, has been submerged and forgotten since the advent of the 'marginal' method [p.v]", as the gravitation mechanism was clearly part of Adam Smith's and Ricardo's systems. The answer to this question can be found in one of Sraffa's notes of the period of his early breakthrough:

> When A. Smith etc. said <u>'natural'</u> he did not in the least mean the 'normal' or the 'average' nor the 'long run' value. He meant that physical, truly natural relations between commodities, that is determined by the equations, and that is not disturbed by the process of securing a greater share in the product. … (PSP D3/12/11, quoted in Garegnani 2005, p. 474, underline in original).

Clearly, from the beginning of his new theoretical adventure Sraffa had completely discounted the notion of 'centre of gravitation' as part of the 'classical standpoint'. The reader should note that we are here not concerned with the "correctness" of Sraffa's reading of Adam Smith. The evidence shows that when Sraffa uses the word "natural price" of classical economists, he is not using it as the long-term equilibrium or centre of gravitation price. It should also be noted that in his lecture notes of 1928 Sraffa spends a lot of time on the classical theory of value. However, it is the *objective* aspect of the classical theory of value that is emphasized there and the notion of the centre of gravitation is completely ignored.

The second alleged evidence is that Sraffa also refers to the approach of his book being "reminiscent of certain points of view taken by the old classical economists from Adam Smith to Ricardo …" They are all listed in Appendix D of the book: (1) Quesnay's *Tableau Economique* is credited for the circular point of view; (2) The notion of basic goods could be discerned in Ricardo's 'corn model'; (3) The idea of the Standard commodity could also be discerned in Ricardo; (4) the notion of maximum rate of profits is found in Marx; and (5) the treatment of fixed capital as a kind of joint-product could be found in Torrens. Interestingly, we find that there is no reference to the notion of "natural prices" or the "centre of gravitation" in the list. If Sraffa had accepted the notion of the centre of gravitation in his book, then the question is: why did he not acknowledge Adam Smith for this idea? Why would he ask the reader not to bring the baggage of the thinking in terms of equilibrium of demand and supply in the very first sentence of the 'Preface', and then go on to implicitly assume it throughout the book?

Anyway, the most important evidence that is invoked in favour of the received interpretation is Sraffa's statement in the book that "Such classical terms as 'necessary price', 'natural price' or 'price of production' would meet the case, but value and price have been preferred as being shorter and in the present context (which contains no reference to market prices) no more ambiguous." (Sraffa 1960, 9). A close reading of this passage, however, confirms our interpretation and rejects the received interpretation. As

we have shown above, quantitatively Sraffa's price is the same as Smith's and Ricardo's 'natural price' and Marx's 'price of production'; however, Sraffa's price is not defined to hold only at the centre of gravitation. Thus it does not need any reference to 'market prices'. Sraffa's caveat that his context "contains no reference to market prices" takes away the essential element of the gravitational mechanism. It is the 'market prices' that gravitate toward the centres of gravitation in the classical system. What meaning could be assigned to a concept whose essential compliment is deliberately left out of the theoretical context? Can we imagine a centre of gravitation in a space without matter? Finally, on page 33 of the book Sraffa argued that "The rate of profits, as a ratio, has a significance which is independent of any prices, and can well be 'given' before prices are fixed. It is accordingly susceptible of being determined from outside of the system of production, in particular by the level of the money rates of interest." This clearly points to the fact that no gravitation mechanism is postulated in his theory, as the equalisation of the rate of profits is precisely the result of the gravitation mechanism of the classical theory and taking a uniform rate of profits from outside the system *ipso facto* rules out the market mechanism of supply adjustments and market price changes that brings about this result.

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