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Marx's Metaphysics of Human Labour in the Light of Sraffa: Labour Theory of Value Reconsidered

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I. Labour as the Ultimate Cause of Value in Classical Economics

In this chapter, I analyse the foundations of Marx's analysis of a capitalist economy in terms of labour time to locate the root cause of Marx's problem of relating values to prices and surplus values to profits, and then, show how Sraffa succeeds in solving the problem by liberating Marx from his metaphysics of "human labour."

The idea of measuring commodities in units of labour time is, however, not originally Marx's. It was used in earnest by Adam Smith,[1] who wanted to find a standard of measure for the values of commodities so that the *real* wealth of a nation could be compared over periods of time, independently of fluctuations in the prices of commodities. He thought that if the

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[1] Adam Smith, *An Inquiry into the Nature and Causes of the Wealth of Nations*, Vol. I (Indianapolis: Library Fund, 1981).

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ultimate cause of value could be discovered, then that could provide us with the standard that will remain invariant in the face of apparent changes in prices. This led Adam Smith to think of man's primordial state when he must have had to act *directly* against nature to wrest his basic needs of survival from it. For Adam Smith, this primordial act of man against nature is both an act of *production* as well as an act of *exchange*. Expenditure of labour in the process of production is also a sacrifice in terms of "toil and trouble," which is a payment of price for the product appropriated from nature. Thus, all prices or all economic values must be measured by this "originary" or the ultimate price, which measures the "real" value of the commodity as opposed to the "nominal" value measured by the money-commodity, such as gold or silver. After having determined the standard of measure of values of commodities in a commodity's ability to command certain length of time of the labourer or his "sacrifice of labour," Adam Smith developed a theory of value in terms of accounting of the income generated in production by "adding up" wages, profits, and rent, which he considered were known data at any given point of time.

Ricardo[2] rejected Adam Smith's "adding up" theory of value on the grounds that the value of total income must be fixed independently of how it is cut between various recipients of it. From this point of view, Adam Smith's explanation of why labour is the ultimate cause of value also becomes problematic—if labour as "sacrifice" is the cause of value of the commodity, then a change in the cause must result in a change in the effect, and thus a fall in the real wage—which implies an increase in the sacrifice to acquire a commodity for the labourer—must lead to an increase in the value of the commodity. This contradicts Ricardo's proposition that the size of the total must be independent of how it is cut for different recipients. Therefore, Ricardo removed the *subjective* interpretation of labour and proposed an alternative hypothesis that labour is the ultimate cause of value not because of the subjective aspect of the "sacrifice" by the labourer as a payment of price for the good received, but because labour in the act of production is an *objective input* and since all other inputs of production can be reduced to labour in the final analysis, it is the ultimate cause of value. From this perspective, Ricardo needed to show that changes in prices of commodities must, in the final analysis, be explained solely by showing changes in the labour input required to produce the commodities.

[2] David Ricardo, *Principles of Political Economy and Taxation* (Cambridge: Cambridge University Press, 1951).

But Ricardo had to admit that in a general case, when the technique of producing commodities are such that their ratios of direct to indirect labour inputs are not equal, then changes in wages can have an independent effect on prices, that is, prices can change without any changes in their labour inputs, thus violating the fundamental proposition that labour is the ultimate cause of value.[3]

II. Surplus Value and Marx's Metaphysics of Human Labour

Marx had a fair inkling that Adam Smith's (and also Ricardo's) idea that in the final analysis, all production can be reduced to man's direct labouring activity against nature may be logically flawed since it may not be possible to reduce the material means of production to zero as one goes back and back in the production chain to draw a long series of labouring activity pure and simple. In *Capital* Volume II, Marx wrote:

> The statement that the entire price of commodities is either "immediately" or "ultimately" resolvable in v + s [wages + surplus] would only cease to be an empty subterfuge if Smith could demonstrate that the commodity products whose price is immediately resolved into c (the price of the means of production consumed) + v + s are finally compensated for by commodity products which entirely replace these "consumed means of production", and which are for their part produced simply by outlay of variable capital [wage advances only], i.e., capital laid out on labour-power. The price of these latter commodities would then immediately be v + s. And in this way the price of the former, too, c + v + s, where c stands for the component of constant capital, would be ultimately resolvable into v + s. Adam Smith himself did not believe he had given such a proof.[4]

Marx's fundamental attack on political economy was that neither Adam Smith nor Ricardo could explain the source of profits. Both Adam Smith and Ricardo take profits as a given income category in a bourgeois economy. Adam Smith's argument that profit is a return on "risk taking" can be a reasonable explanation for differential rates of interest on capital due

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[3] For my detailed analysis of Adam Smith's and Ricardo's theories of value, see Ajit Sinha, *Theories of Value from Adam Smith to Piero Sraffa* (London: Routledge, 2018) and *Essays on Theories of Value in the Classical Tradition* (Cham: Palgrave Macmillan, 2019).

[4] Karl Marx, *Capital*, Vol. II (London: Penguin Classics, 1992), 450.

to differential risks involved in different industries, but it cannot be an explanation for the origin of profits since "risk" does not produce anything. Ricardo also takes a positive rate of profits as given and only analyses how it is affected by changes in the value of wages. So, one of the fundamental projects that Marx takes up in *Capital* was to explain the source of profits.

To answer the question, where do profits come from?, Marx first claims that "[t]he wealth of societies in which the capitalist mode of production prevails appears as an 'immense collection of commodities'; the individual commodity appears as its elementary form. Our investigation, therefore, begins with the analysis of the commodity."[5] He argues that an economic good takes a commodity form if it is produced for exchange against some other good. He then posits that a relation of exchange is a relation of equality, and asks the question: if one-quarter of corn exchanges against one quintal of iron, then what could be the common substance in the two highly disparate use values that must be present in equal amount in the two commodities? His answer is that the "common substance" can be nothing else than the fact that both are "products of labour." And therefore, exchange of commodities represents exchange of equal labour. But of course, the labour of an ironsmith is qualitatively as different from the labour of a farmer as iron is different from wheat. Marx argues that though it is true that "concrete labours" of an ironsmith and a farmer are qualitatively different, nevertheless, underneath them lies expenditure of undifferentiated human energy that can be calculated by a clock.

Leaving aside the problematic nature of Marx's "deduction" or "discovery" of exchange of equal undifferentiated labour residing underneath the exchange of commodities,[6] it is curious that Marx argues this, knowing well from his readings of Ricardo that such a "deduction" would be incorrect for the most general case of capitalist economies. As a matter of fact, Marx had already worked out his solution to the "transformation problem" in his manuscripts of the early 1860s and therefore was well aware that the results of his "deduction" were incorrect—he gives a hint of it at the end of Chapter 5 in a footnote: "How can we account for the origin of capital on the assumption that prices are regulated by the average price, i.e., ultimately by the value of the commodities? *I say 'ulti-*

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[5] Karl Marx, *Capital*, Vol. I (New York: Vintage, 1977), 125.
[6] See Ajit Sinha, *Theories of Value from Adam Smith to Piero Sraffa* (London: Routledge, 2018) for a discussion on this point.

mately' because average prices do not directly coincide with the values of the commodities."[7] Thus, it would be fair to interpret that the "deduction" of equal labour in exchange for the exchange of commodities is a supposition. Marx, at this stage of analysis, could be implicitly assuming an equal ratio of direct to indirect labour time for all the industries, or at least, we can make sense of it by making that assumption.

The strategy Marx employs is to argue that a commodity in a barter exchange relation appears as C_1–C_2, which represents equal undifferentiated labour. By introducing money-commodity as a means of transaction, we can expand the relation of exchange to C_1–M–C_2, which does not change the nature of the relation. However, in a capitalist economy, he argues, a capitalist is not interested in selling a commodity to buy another commodity for consumption. His interest is to invest money as capital to withdraw more money at the end of the circuit. Thus, a circuit of capital in the sphere of exchange begins with a single capitalist starting with some money capital M, exchanging it for some commodities C, and then exchanging C back for money M. If both the M, before and after the exchanges, remain equal, then the whole process would appear to be a mad exercise. Thus, for this circuit to have any meaning for the capitalist, the terminal M must be quantitatively larger than the initial M; in other words, the circuit must be of the form M–C–M′, M′ > M. The problem Marx poses to himself is: if equal labour-values exchange in the commodity sphere, then where does the difference between M′ and M come from?

> The transformation of money into capital has to be developed on the basis of the immanent laws of exchange of commodities, in such a way that the starting-point is the exchange of equivalents. The money-owner, who is yet only a capitalist in larval form, must buy his commodities at their value, sell them at their value, and yet at the end of the process withdraw more value from circulation than he threw into it at the beginning. His emergence as a butterfly must, and yet must not, take place in the sphere of circulation. These are the conditions of the problem. *Hic Rhodus, hic salta!*[8]

One of Marx's central criticisms of political economy was that both Adam Smith and Ricardo did not understand the true nature of wage as an income category. They treated wage as a price paid to the labourer for the labour services performed. Marx argues that wage as a specific form of

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[7] Marx, *Capital*, Vol. I, 269f24; (emphasis added).
[8] Ibid., 268–9.

income for the labouring class is the *differentia specifica* of capitalism. In capitalism, workers, de jure, appear as independent commodity owners exchanging commodities with other independent commodity owners. But the commodity they sell to the capitalists in exchange for wages is not the labour services as such, but rather their capacity to work, which Marx called labour-power. And the value of the labour-power is determined by the same principle as the value of any other commodity, that is, by the labour time it takes to (re)produce the labourer's capacity to work. Thus, in this specific exchange, a specified wage basket of commodities stands on one side and the labour-power stands on the other. However, one peculiarity of this particular commodity, the labour-power, is that its consumption or use in the production process adds to the value of the raw materials and other such that it works on. Another peculiarity of this particular commodity is that the workers' capacity to work is quite elastic—an average worker can or can be made to work any number of hours below a certain natural maximum in a day. In a capitalist economy, it so happens that the technique of production has become so productive that the wage basket needed to (re)produce the worker's capacity to work is produced in much less labour time than the maximum limit to which a worker can work in a day, and therefore the capitalists are able to stretch the working day beyond the labour time needed to produce the wage basket. In other words, workers give more labour time in the process of production than they receive in return as their wages. Thus the value they add in the process of production is higher than the value they take away as wages. This difference represents "surplus value," which is the source of profits.

Thus, the total value of a commodity has three components—the first component is the constant capital (c), which is the value of raw materials and means of production used up in the process of production plus the fresh labour added by the labourers, which in turn has two components—variable capital (v), which is the value of the wage goods that workers receive and the other is the surplus value (s), which is the extra labour time the worker is made to work over and above the labour time needed to produce the wage basket. In other words, if value of one ton of iron is λ_i then $\lambda_i = c_i + v_i + s_i$, where c_i stands for the value of the raw materials and used-up machines and other such in the production of one ton of iron, and v_i and s_i, respectively, stand for the value of wage goods received by the workers in producing one ton of iron and the difference between the

total labour time worked by the workers to produce one ton of iron and the value of the wages received by them.

Now, let us analyse the three components of λ_i separately. How do we determine c_i? It appears that to determine the value of a commodity, one needs to already know the value of other commodities that it uses as its raw materials and other means of production. In Adam Smith's and Ricardo's conceptual framework, one could go back and back in the chain of production of means of production till one hits upon a stage where labour all alone produced the first means of production. But as we have seen above, Marx had rejected this conceptual framework. One way to get out of this circle would be to argue that the value of all the commodities that directly or indirectly go into the production of iron are determined simultaneously. So let us borrow Sraffa's example of an economic system given by:

$$90 \text{ t. iron} + 120 \text{ t. coal} + 60 \text{ qr. wheat} + 3/16 \text{ labour} \rightarrow 180 \text{ t. iron}$$
$$50 \text{ t. iron} + 125 \text{ t. coal} + 150 \text{ qr. wheat} + 5/16 \text{ labour} \rightarrow 450 \text{ t. coal}$$
$$40 \text{ t. iron} + 40 \text{ t. coal} + 200 \text{ qr. wheat} + 8/16 \text{ labour} \rightarrow 480 \text{ qr. wheat}$$

Let us say that the unknown labour-values of iron, coal, and wheat are given by λ_i, λ_c, and λ_w, respectively. Since the units of labour-values are the same as the unit of direct labour, they can be added to each other. Given Marx's proposition that total value of a commodity is determined by the value of the constant capital plus the direct labour time used in its production, we can convert the above description of a system of production to a set of simultaneous equations such as:

$$90\lambda_i + 120\lambda_c + 60\lambda_w + 3/16 \text{ labour} = 180\lambda_i$$
$$50\lambda_i + 125\lambda_c + 150\lambda_w + 5/16 \text{ labour} = 450\lambda_c$$
$$\underline{40\lambda_i + 40\lambda_c + 200\lambda_w + 8/16 \text{ labour} = 480\lambda_w}$$
$$180\lambda_i + 285\lambda_c + 410\lambda_w + 1 \text{ labour} = 180\lambda_i + 450\lambda_c + 480\lambda_w \qquad (1)$$

These three equations will solve for values of λ_i, λ_c, and λ_w in terms of labour time along with the value of the net output $\left(165\lambda_c + 70\lambda_w\right) = 1 \text{ labour}$. Now, to understand the nature of Marx's proposition that equal values exchange, let

us change the unknowns from labour-values to prices such as p_i, p_c, and p_w. Since the unit of prices is not in terms of labour time, we will have to convert direct labour units to its counterpart in terms of price, which would be its income or wages.

$$90p_i + 120p_c + 60p_w + 3/16(165p_c + 70p_w) = 180p_i$$
$$50p_i + 125p_c + 150p_w + 5/16(165p_c + 70p_w) = 450p_c$$
$$40p_i + 40p_c + 200p_w + 8/16(165p_c + 70p_w) = 480p_w$$
$$\overline{180p_i + 285p_c + 410p_w + 1(165p_c + 70p_w) = 180p_i + 450p_c + 480p_w} \quad (2)$$

The solutions for ps will confirm Marx's proposition that $\lambda_i / \lambda_c = p_i / p_c$, $\lambda_i / \lambda_w = p_i / p_w$, and $\lambda_c / \lambda_w = p_c / p_w$. It should, however, be noted that this result is contingent on the assumption that labourers receive their share of total net income in the same proportion as their share of the expenditure of labour time in the total expenditure of direct labour time in the economy. If that were not so, for example, suppose coal workers received higher income per unit of expenditure of labour, then the ratios of ps will deviate from the ratios of λs, and thus, Marx's proposition will no longer be true. Now, so long as we assume that all the three kinds of labour are unskilled or simple labour of equal intensity, then, as Adam Smith and Ricardo had argued, a rational calculation on the part of iron and wheat workers will make them move from the iron and wheat industries to the coal industry, bringing down coal prices vis-à-vis iron and wheat, and therefore bringing the ratio of ps in conformity with the ratios of λs, and so, the law of value must prevail in the long run. However, let us suppose that the work of a coal miner is more intense than the work of an ironsmith or a farmer. In that case, the coal miner must receive a higher return per unit of labour than the other two workers, otherwise coal mining will disappear in the long run. In this case, whatever differential returns that get established in the society for the coal miners will determine the ratios of ps; and for Marx's proposition to hold, one will have to change the values by counting every unit of the coal miner's labour by as higher a proportion as its share in total income. In other words, *the measure of labour time itself must become contingent on how the income (or the net output) is distributed among the workers—it is the prices that determine values*! Marx admits that in the real world, the differentials in returns to labour have very little to do with the actual expenditure of human energy:

More complex labour counts only as *intensified*, or rather *multiplied* simple labour, so that a smaller quantity of complex labour is considered equal to a larger quantity of simple labour. Experience shows that this reduction is constantly being made. A commodity may be the outcome of most complicated labour, but through its *value* it is posited as equal to the product of simple labour. The various proportions in which different kinds of labour are reduced to simple labour as their unit of measurement are established by a social process that goes on behind the backs of the producers; these proportions therefore appear to the producers to have been handed down by tradition.[9]

The distinction between higher and simple labour, "skilled labour" and "unskilled labour", rests in part on pure illusion or, to say the least, on distinctions that have long since ceased to be real, and survive only by virtue of a traditional conventions[10];

Hence, the measure of labour time and consequently the values of commodities are determined by the conventional differentials in returns to various kinds of labour.

Up till now, we have been assuming that all the net income generated in the economy is appropriated by the labourers themselves as returns to their labour inputs in production and hence the material means of production have not yet become "capital" in Marx's sense. But once we push down the returns to the labourers from 100% of total income to less than 100%, then a surplus income emerges. Till now, we have homogenized heterogeneous labour by taking the income differentials as the multiplication factors for measuring homogeneous labour. In the current context, the same principle translates into measuring direct labour inputs by equating one-to-one their proportion of wage bill to the total wage bill in the economy, with their proportion of direct labour input to the total direct labour input in the economy. Now, the surplus that has emerged needs to be accounted for as "profits on capital." Ricardo had already established that if the indirect-to-direct labour ratios (or in Marx's case, c/v, since $c/(v+s) = (c/v)/(1+s/v)$, given that it is assumed that s/v are equal, the proposition boils down to equality or inequality of c/v) are equal across industries, then a percentage decline in wages across industries would generate equal percentage returns on capital across industries, given the measure of capital on the basis of the old prices, and therefore there will be no

[9] Ibid., 135.
[10] Ibid., 305f19.

rational reason for prices to change; but if the ratio of direct to indirect labour (or c/v) is not equal across industries, which is the general case, then industrial returns to capital will be unequal, given the measure of capital on the basis of the old prices. In Marx's terms, when surplus value emerges, then, on the basis of the old prices, the industrial rate of profits must be given by: $r_j = s_j / (c_j + v_j) = (s_j / v_j)/(c_j / v_j + 1)$, where "$j$" represents the industry. Since s_j / v_j is assumed to be equal for all industries, unequal c_j / v_j would result in unequal r_j. This, Marx maintained, following Smith and Ricardo, cannot be a stable position in the long run as rational calculation by capitalists would generate movement of capital from low profits industries to high profits industries, forcing prices to readjust by relatively raising the exchange ratios of low profits industries compared to high profits industries. Ricardo had understood that once this happens, then capital can no longer be measured by the old prices, and so he had to give up the project of determining prices and the rate of profits and concentrate on analysing only *changes* in those variables. Marx also poses the problem in desperate terms: "it might seem that we must abandon all hope of understanding these phenomena,"[11] but then goes on to provide a solution for the determination of new set of prices and the equal rate of profits in the system.

Marx's solution to this problem was simple, but unfortunately incorrect. He correctly reckons that if all industries must receive an equal rate of profits, then it must be the average rate of profits of the system. He, however, proposes to derive the average rate of profits from the given labour-value magnitudes by dividing the aggregate surplus value in the system by the aggregate of constant plus variable capitals in the system. In other words, if $\sum s_j = S$ and $\sum(c_j + v_j) = (C + V)$, where $j = 1, ..., n$, then Marx's average rate of profits (r) is given by $S/(C + V)$. After calculating the average rate of profits (r), he applies this rate of profits to mark up the values of each industry's constant plus variable capital by the average rate of profits to derive the "price of production" of each commodity. In other words, the price of production for each commodity is given by: $(c_j + v_j)(1 + r) = (c_j + v_j)\{(C + V + S)/(C + V)\}$. It is evident from the above equation that $\sum(c_j + v_j)(1 + r) = C + V + S$ and $\sum(c_j + v_j)r = S$. In other words, total prices of production is equal to total labour-values and

[11] Karl Marx, *Capital*, Vol. III (London: Penguin Classics, 1991), 252.

total profits is equal to total surplus values. Marx's contention is that in a competitive capitalist economy, commodities do not exchange in proportion to their labour-values, but rather in proportion to their prices of production. But this in itself does not invalidate the basis of his analysis of capitalism in terms of labour-values and its three main components, since the average rate of profits and the prices of production are derived from value magnitudes and cannot be derived otherwise; and given the results that the sum of the prices of production is proportional to the sum of values, and the sum of profits is proportional to the sum of surplus values, it stands as a proof that the source of profit is surplus value. The competitive mechanism of the capitalist system only succeeds in obscuring this fundamental truth by a reallocation of the total surplus values among the capitalists through the price mechanism; but the nature of the fundamental relation between the capitalists and the workers, analysed on the basis of labour-values of commodities, remains intact at the level of the system as a whole:

> The price of production includes the average profit. And what we call price of production is in fact the same thing that Adam Smith calls 'natural price', Ricardo 'price of production' or 'cost of production', and the Physiocrats '*prix nécessaire*', though none of these people explained the difference between price of production and value. We call it the price of production because in the long term it is the condition of supply, the condition for the reproduction of commodities, in each particular sphere of production. We can also understand why those very economists who oppose the determination of commodity value by labour time, by the quantity of labour contained in the commodity, always speak of the prices of production as the centres around which market prices fluctuate. They can allow themselves this because the price of production is already a completely externalized and *prima facie* irrational form of commodity value, a form that appears in competition and is therefore present in the consciousness of the vulgar capitalist and consequently also in that of the vulgar economist.[12]

This clearly does not solve the problem, however. Since the ratios of prices of production are not equal to the ratios of labour-values any more, the measure of capital on the basis of their labour-values becomes illegitimate, and hence Marx's determination of the average rate of profits of the

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[12] Ibid., 300.

system is not the correct average. In other words, Ricardo's problem remains unsolved. We still do not have the determination of either prices or the average rate of profits. Marx apparently was well aware of it as he goes on to admit:

> The development given above also involves a modification in the determination of a commodity's cost price. It was originally assumed that the cost price of a commodity equaled the *value* of the commodities consumed in its production. But for the buyer of a commodity, it is the price of production that constitutes its cost price and can thus enter into forming the price of another commodity. As the price of production of a commodity can diverge from its value, so the cost price of a commodity, in which the price of production of other commodities are involved, can also stand above or below the portion of its total value that is formed by the value of the means of production going into it. *It is necessary to bear in mind this modified significance of the cost price, and therefore to bear in mind too that if the cost price of a commodity is equated with the value of the means of production used up in producing it, it is always possible to go wrong.*[13]

It is curious that even though Marx rejected the classical idea of deriving labour as the ultimate factor of production by reducing production to man's direct labour against nature and consistently criticized Adam Smith and Ricardo in his *Theories of Surplus Value* for reducing all capital to only wage advances and forgetting the material means of production in their inquiry of the rate of profits, he nevertheless throughout maintains that commodities are "products of labour." As a matter of fact, Marx from a very early stage had rejected the idea of starting the analysis of production from the imagined primordial relation between man and nature. In his *Economic and Philosophic Manuscripts of 1844*, Marx wrote: "Do not let us go back to a fictitious primordial condition as the political economist does, when he tries to explain. Such a primordial condition explains nothing"[14] and one year later, in *The German Ideology*, Marx and Engels wrote: "The premises from which we begin are not arbitrary ones, not dogmas, but real

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[13] Ibid., 264; emphasis added.
[14] Karl Marx, *The Economic and Philosophic Manuscripts of 1844* (New York: International Publishers, 1964), 107.

premises from which abstraction can only be made in the imagination. … These premises can thus be verified in a purely empirical way."[15]

However, by the time we get to the "Introduction" to the *Grundrisse*,[16] which was written in 1857, Marx appears to question the idea of the beginning of analysis from empirical givens. Here, Marx seems to suggest that beginning with a concrete empirical reality may be a false beginning. He argues that a quick reflection on such concrete reality as "population" makes it clear that it is a chaotic whole unless it is understood in terms of more abstract categories such as classes, which in turn rest on further abstract categories such as capital and wage labour and so on. Thus, starting from the most abstract categories and building up to the understanding of concrete reality is "obviously the scientifically correct method." Marx further argues that the theoretical construct of building up from most simple or abstract categories to the concrete empirical whole does not represent some sort of real historical unfolding, as Hegel thought. On the contrary, it is the state of development of the current stage of society in which the theoretician finds himself embedded is what determines his ability for abstraction—the more complex and advanced a society is, the more clearly it can see the abstractions. Hence, Adam Smith and Ricardo, who were situated in late eighteenth- and early nineteenth-century Scotland and England, could see labour as such as an abstract category because the society in which they were embedded had become highly manufacturing oriented, with extensive division of labour and free movements of workers from one branch of production to another. Whereas, the Mercantilists' and Physiocrats' visions were constrained by the predominance of one kind of specific labour such as commercial or agricultural, which did not allow them to see the abstract aspect of labour in general.

Though the "Introduction" was drafted to be the Introduction of *A Contribution to the Critique of Political Economy* published in 1859, Marx decided not to include it in the publication since he thought it "anticipated the results which still had to be substantiated" and replaced it with a relatively brief "Preface." In the Preface, on the question of the beginning, he simply states that "the reader who really wishes to follow

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[15] Karl Marx and Frederick Engels, *The German Ideology* (New York: International Publishers, 1991), 42.

[16] Karl Marx, *Grundrisse* (Middlesex: Pelican Books, 1973).

me will have to decide to advance from the particular to the general."[17] Instead of any elaboration on the question of "scientific method" and of "beginning" of analysis, we find in this brief Preface a general statement of historical materialism, which he presents as "the guiding principles of his studies":

> In the social production of their existence, men inevitably enter into definite relations, which are independent of their will, namely relations of production appropriate to a given stage in the development of their material forces of production. The totality of these relations of production constitutes the economic structure of society, the real foundation, on which arises a legal and political structure and to which correspond definite forms of social consciousness. The mode of production of material life conditions the general process of social, political and intellectual life. It is not the consciousness of men that determines their existence, but their social existence that determines their consciousness.[18]

Here, we find that the object of analysis is no longer characterized as "concrete whole" such as "population," "nation state," and so on, but rather a mode of production, a theoretical construct of a stage in human history, the foundations of which are determined by how men relate to each other through their labour. Thus, the subject matter of economic analysis is defined by *human labour*—it is the ensemble of human relations in the act of production of their material conditions of existence. We find a continuation of this theme in *Capital* published in 1867. In fact, *Capital* was supposed to be in "continuation" of *A Critique* and the first chapter of the first edition of *Capital* was supposed to be a summary of it. In the "Preface" to the first edition of *Capital*, Marx proclaims that "What I have to examine in this work is the capitalist mode of production, and the relations of production and forms of intercourse [*Verkehrsverhaltnisse*] that correspond to it."[19]

It appears that Marx's notion of "human labour" as the "substance" of value is based on the idea of a mode of production as an ensemble of human relations mediated through *human labour*—the play is all about human labour—this is Marx's fundamental metaphysics. In capitalism,

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[17] Karl Marx, *A Contribution to the Critique of Political Economy* (New York: International Publishers, 1970), 19.
[18] Ibid., 20–1.
[19] Marx, *Capital*, Vol. I, 90.

humans relate to each other through their labour at two levels. First of all, there is extensive division of human labour in society, which is regulated through the market mechanism of commodity exchange—it is the impersonal market that regulates the social division of labour. Thus, underneath the relations of commodities lies the proportion of total labour allocated to the production of various commodities. The other relation of production of a capitalist economy is that the labourers do not appropriate their products but sell their capacity to work as a commodity to the capitalist for a wage (or a bundle of commodities). This again is regulated by the market and is represented by the proportion of total labour allocated to producing the total wage basket. Now, if the total labour allocated to producing the total wage basket is less than one, then the rest of the total labour must be allocated to producing commodities that are appropriated by the non-working class—in this case, the capitalists. This must also be represented by the proportion to total labour allocated to producing the commodities appropriated by the capitalists—this proportion of the total labour is surplus value, which is appropriated by the capitalists as profits. The source of the surplus value, however, can only be explained when we "leave this noisy sphere [market for commodity exchange], where everything takes place on the surface and in full view of everyone, and follow them [the capitalist and the worker] into the hidden abode of production, on whose threshold there hangs the notice 'No admittance except on business'."[20]

The conflict between Marx's *metaphysics* and *physics* of production explains the discrepancy between Marx's reasoning and his mathematics. From a purely scientific point of view, the *human contribution* to production is nothing but a contribution of mechanical energy, which in essence, is no different from animal's energy or even energy contributed by machines in the process of production. As horses or bullocks could be replaced by tractors in agriculture, humans can also be replaced by mechanical machines and robots once they become cheaper to employ than humans. This does not mean that such technical changes must lead to a fall in the surplus production—if that was the case, then such labour-replacing techniques will not be introduced in the first place. This brings us to inquire into the nature of surplus. According to the first law of thermodynamics, the total energy in the universe is constant; thus, no surplus can be produced in the universe as a whole. However, if we restrict a domain within the universe and create an "inside" and "outside," then a

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[20] Ibid., 279–80.

surplus can be produced in the "inside" domain by taking energy from outside. One can think of economic production as conversion of "outside" energy of nature, which is freely available, and thus, has no economic value, to a form of energy that has economic value—this was fundamentally the approach the Physiocrats took in defining surplus output. Thus, surplus production in the field of economics is simply an aspect of the technique of production—all that is needed for surplus to be produced is that the total economic values of all the inputs used up should turn out to be less than total economic value of all the outputs produced—that is why wine maturing in the cellar or crops growing in the fields add to the surplus. Marx's idea that only human labour adds economic value in the process of production unwittingly harks back to the classical notion of labour being the ultimate cause of value.

III. Sraffa: From Marx's Metaphysics of Human Labour to Physics of Production

Sraffa[21] stays clear from all the humanist moorings of classical economics and Marx. The revolution of the 1870s that swept economics had rejected the classical idea that labour is the ultimate cause of value. Instead, they argued that the ultimate cause of value is scarcity, which is fundamentally a subjective condition of the intensity of our desire for something in relation to its availability. If something is not freely available in the amount that will satiate us, then we are willing to pay a price for it, which can be a sacrifice of our comfort or sacrifice of anything that we possess which has positive utility for us—there is nothing special about loss of comfort or leisure (i.e., labour) as a sacrifice for acquiring something of value. In this context, forgoing consumption is no different from forgoing comfort or leisure, and therefore, if forgoing comfort or leisure (i.e., labour) must receive a return for it (i.e., wages), then forgoing consumption, which is how capital investment can be interpreted, must also receive a return as profits. Now the question is, how do we measure the sacrifice of consumption? Let us suppose a farmer "A" sacrifices one quintal of consumption of wheat just harvested and uses it as seed for production of wheat in the next harvest cycle and another farmer "B" sacrifices one quintal of wheat to use as seed for production of wheat, and then another harvest cycle to turn it

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[21] Piero Sraffa, *Production of Commodities by Means of Commodities* (Cambridge: Cambridge University Press, 1960).

into bread. Should the two farmers receive the same return on their equal sacrifice of consumption of one quintal of wheat? The answer is no; because farmer "B" has sacrificed one quintal of wheat for two time periods whereas farmer "A" has done it only for one. Therefore, farmer "B" must receive a higher profit. What we have noticed here is that the notion of sacrifice of consumption has a time dimension as the notion of labour. This gave rise to the idea that capital could also be measured in the time dimension as "time of waiting" by going back and back in the production cycle of any commodity till we hit upon the primordial state. This was the approach taken up by Jevons,[22] Menger,[23] Böhm-Bawerk,[24] and Wicksell[25] and had become highly influential in the profession as the alternative to the classical (and Marx's) explanation of profits in terms of some kind of deduction from what legitimately belonged to the workers. In the late 1920s, Sraffa had set himself a task of demolishing the theories that rooted economic calculations or the cause of prices and profits in human subjectivity or human psychology. But the successful destruction of it would also amount to the destruction of the old labour theory of value as they are the two sides of the same coin.

Sraffa soon realized that in a commodity producing society where means of production are produced by separate industries and bought and sold by each other in the manner as any final or consumption goods are, then it is impossible to trace back production of any commodity to its primordial state—production of commodities is always by means of commodities. No matter how far back we go in the chain of production, some *commodity residue* will always remain—the road to the primordial stage is theoretically blocked forever. Though it is true that by going back and back in the production chain one can always reduce the commodity residue to negligible proportion, and thus ignore it in the calculation of a long chain of labouring activity, it so happens that at what stage the commodity residue becomes negligible depends upon the rate of wages—if wages are relatively high, then the commodity residue will become negligible more quickly than when wages are comparatively low; and if wages are zero, then the commodity residue will never become negligible. This

[22] W.S. Jevons, *The Theory of Political Economy* (New York: Kelly & Millman, Inc., 1957).

[23] Carl Menger, *Principles of Economics* (Auburn: Ludwig von Mises Institute, 2007).

[24] Eugen von Böhm-Bawerk, *Capital and Interest*, Vols. 1–3 (Illinois: Liberation Press, 1959).

[25] Knut Wicksell, *Lectures on Political Economy, Vol. I: General Theory* (London: George Routledge and Sons, Ltd., 1934).

reveals a fundamental mistake in understanding the relationship between wages and profits when we root our theory of production in the idea of primordial relation of man to nature—if we could reduce the production chain to the primordial stage, then we could reduce all capital investment to a long series of only wage advances, and in this case, if wages go to zero, then the rate of profits must become infinity; however, if there must remain a commodity residue, no matter how far back we go in the production chain, then when wages go to zero, the rate of profits must reach a finite maximum. This theoretical insight had a momentous implication for Sraffa's theory—later, Sraffa credited Marx for this insight:

> The notion of a Maximum rate of profits corresponding to a zero wage has been suggested by Marx, directly through an incidental allusion to the possibility of a fall in the rate of profits 'even if the workers could live on air'; but more generally owing to his emphatic rejection of the claim of Adam Smith and others after him that the price of every commodity 'either immediately or ultimately' resolves itself entirely (that is, to say, without leaving any commodity residue) into wage, profit and rent—a claim which necessarily presupposed the existence of 'ultimate' commodities produced by pure labour without means of production except land, and which therefore was incompatible with a fixed limit to the rise in the rate of profits.[26]

The fact that there always remains a commodity residue rules out the possibility of conceptualizing industries as independent silos which produce all their means of production themselves and only exchange their final commodities or consumption goods. Once the idea of independence of industries is rejected, we realize that social production relies on a complex web of interconnected industries that produce at least one good that goes directly or indirectly into the production of all goods. An interconnected web of all such "basic goods" form a social system of production, where removal of one such industry would amount to complete cessation of the whole economy. It is in this context that we can understand why the industries get structurally constrained such that its productivity or the maximum rate of profits of the system becomes a physical property of the system of production.

Sraffa's theoretical story begins with a subsistence system, which is similar to Adam Smith's "early and rude state of society" or Marx's "simple commodity production." The characteristic of this system is that it pro-

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[26] Piero Sraffa, *Production of Commodities by Means of Commodities* (Cambridge: Cambridge University Press, 1960), 94.

duces outputs exactly equal to what it uses as inputs—there is no net output production in the sense that all the income received by the labourers appear as necessary consumption similar to feed for the horses. So, suppose such a system is given by:

90 t. iron + 120 t. coal + 60 qr. wheat → 180 t. iron

50 t. iron + 125 t. coal + 150 qr. wheat → 285 t. coal

40 t. iron + 40 t. coal + 200 qr. wheat → 410 qr. wheat

180 t. iron + 285 t. coal + 410 qr. wheat → 180 t. iron + 285 t. coal + 410 qr. wheat

In price terms, this system can be represented by:

$$90p_i + 120p_c + 60p_w = 180p_i$$
$$50p_i + 125p_c + 150p_w = 285p_c$$
$$40p_i + 40p_c + 200p_w = 410p_w$$
$$\overline{180p_i + 285p_c + 410p_w = 180p_i + 285p_c + 410p_w} \qquad (3)$$

The condition of "subsistence" that the aggregate of all inputs must be equal to outputs reduces this system of equations to only two independent equations, and thus, given any commodity as the measuring standard, say $p_w = 1$, we can uniquely determine the values of p_i and p_c. Thus, the exchange ratios that will ensure the historical viability of this system is uniquely and completely determined by the objective input-output data—no more information from outside is needed. Now, let us suppose this system becomes more productive and it produces more output than what it uses as inputs, such as:

$$90p_i + 120p_c + 60p_w \rightarrow 180p_i$$
$$50p_i + 125p_c + 150p_w \rightarrow 450p_c$$
$$40p_i + 40p_c + 200p_w \rightarrow 480p_w$$
$$\overline{180p_i + 285p_c + 410p_w \rightarrow 180p_i + 450p_c + 480p_w} \qquad (4)$$

Now the constraint of the aggregate equation of the subsistence system no longer holds, and therefore, technically we do not have an equation system any more. We have three independent inequalities with only two unknowns—the excess values of outputs must somehow be accounted for on the left hand side to turn it into a system of equations again. In this

case, we do not know what exact ratio in which the three commodities must exchange, there can be several exchange ratios that can allow for this system to get back its original means of production to reproduce itself. It was at this stage that classical economists and Marx thought that they needed extra information from outside the equations and introduced the idea of market mechanics and rational behaviour on the part of the agents, which leads to adjustment of supplies with demands in such a way that the system comes to rest when each unit of capital receives equal returns. Thus, on the basis of this extra information, one can introduce one more unknown in the system as the rate of profits such that:

$$
\begin{aligned}
(90p_i + 120p_c + 60p_w)(1+r) &= 180p_i \\
(50p_i + 125p_c + 150p_w)(1+r) &= 450p_c \\
\underline{(40p_i + 40p_c + 200p_w)(1+r) = 480p_w} \\
(180p_i + 285p_c + 410p_w)(1+r) &= 180p_i + 450p_c + 480p_w
\end{aligned}
\tag{5}
$$

Now we can solve for the relative prices and the rate of profits simultaneously.

Sraffa rejects this approach.[27] The assumption of rational behaviour by the agents turns the system into a mechanism where supplies adjust to demands to bring about equal returns to factors and this requires knowledge of how changes in inputs relate to changes in outputs for every industry on the side of supply and consumers' subjectivities on the side of demand. Sraffa was of the opinion that the analyst does not have access to such data. He argues that instead of making any assumption about human behaviour and the technique of production, one may stick to the data available after the "harvest" without asking the question: why people did what they did or how people will behave if the system is not in "equilibrium" of demand and supply? He succeeded in showing that there is enough information in this system of equations to not only determine the unique set of prices and the rate of profits, but also to establish, what he considered, the fundamental propositions of classical economics and Marx that can stand as an alternative to the economics rooted in human subjectivity.

Let us rewrite the equation system (5) without assuming that rate of profits across industries are equal:

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[27] For a detailed analysis of my reinterpretation of Sraffa, see Ajit Sinha, *A Revolution in Economic Theory: The Economics of Piero Sraffa* (Cham: Palgrave Macmillan, 2016).

$$\left(90p_\text{i} + 120p_\text{c} + 60p_\text{w}\right)\left(1 + r_\text{i}\right) = 180p_\text{i}$$
$$\left(50p_\text{i} + 125p_\text{c} + 150p_\text{w}\right)\left(1 + r_\text{c}\right) = 450p_\text{c}$$
$$\left(40p_\text{i} + 40p_\text{c} + 200p_\text{w}\right)\left(1 + r_\text{w}\right) = 480p_\text{w}$$
$$\overline{\left(180p_\text{i} + 285p_\text{c} + 410p_\text{w}\right)\left(1 + R\right) = 180p_\text{i} + 450p_\text{c} + 480p_\text{w}} \tag{6}$$

where r_is represent the industrial rate of profits and R stands for the average rate of profits of the system as a whole. Clearly, the average rate of profits of this system is given by (165 t. coal + 70 qr. wheat)/(180 t. iorn + 285 t. + 410 qr. wheat). This ratio is mathematically undefined because it is a ratio of disproportionate heterogeneous goods. It appears that the average rate of profits cannot be found without the knowledge of prices, which is supposed to homogenize these two collections of heterogeneous goods. We, however, know that multiplying any equation by a constant does not change the information set of the equation system in any way. So, let us multiply the equation for iron industry by 4/3 and the equation for coal industry by 4/5. This turns our equation system (6) to:

$$\left(120p_\text{i} + 160p_\text{c} + 80p_\text{w}\right)\left(1 + r_\text{i}\right) = 240p_\text{i}$$
$$\left(40p_\text{i} + 100p_\text{c} + 120p_\text{w}\right)\left(1 + r_\text{c}\right) = 360p_\text{c}$$
$$\left(40p_\text{i} + 40p_\text{c} + 200p_\text{c}\right)\left(1 + r_\text{w}\right) = 480p_\text{w}$$
$$\overline{\left(200p_\text{i} + 300p_\text{c} + 400p_\text{w}\right)\left(1 + R*\right) = 240p_\text{i} + 360p_\text{c} + 480p_\text{w}} \tag{6$'$}$$

Sraffa called this system of equations the Standard system, and proved that there always exists one and only one set of multipliers (such as 4/3, 4/5, 1) that will convert any given system of equations to its Standard counterpart. Now the average rate of profits of the Standard system, that is, $R*$, can be found out without the knowledge of prices. The ratio $\left(40 \text{ iron} + 60 \text{ coal} + 80 \text{ wheat}\right)/\left(200 \text{ iron} + 300 \text{ coal} + 400 \text{ wheat}\right)$ must always be equal to 1/5 or 20% no matter what prices happen to be, as this ratio is a collection of heterogeneous goods collected in the same proportion. Since the systems of Eqs. (6) and (6$'$) are mathematically equivalent as (6$'$) is only a rescaled system of (6), their mathematical properties must remain the same. Therefore, the systemic average rate of profits of the system derived from (6$'$) must also apply to the equation system (6), that

is, $R = R*$. Now, if the industrial rate of profits are not equal, then some will be greater than the average and some will be smaller than the average. Let us call $r_i = (R + e_i)$, $r_c = (R + e_c)$ and $r_w = (R + e_w)$. Thus we can write our equation system (6) as:

$$(90p_i + 120p_c + 60p_w)(1 + R + e_i) = 180p_i$$
$$(50p_i + 125p_c + 150p_w)(1 + R + e_c) = 450p_c$$
$$(40p_i + 40p_c + 200p_w)(1 + R + e_w) = 480p_w$$
$$\overline{(180p_i + 285p_c + 410p_w)(1 + R) = 180p_i + 450p_c + 480p_w} \qquad (7)$$

By   definition, $\left\{\begin{array}{l}(90p_i + 120p_c + 60p_w)e_i + (50p_i + 125p_c + 150p_w)e_c \\ + (40p_i + 40p_c + 200p_w)e_w\end{array}\right\} = 0.$

Without loss of generality, let us assume that $e_i > 0$ and e_c and $e_w < 0$. Now, again rescale the equation system back to its Standard counterpart by multiplying iron-equation by $4/3$ and coal-equation by $4/5$. We obtain:

$$(120p_i + 160p_c + 80p_w)(1 + R + e_i) = 240p_i$$
$$(40p_i + 100p_c + 120p_w)(1 + R + e_c) = 360p_c$$
$$(40p_i + 40p_c + 200p_w)(1 + R + e_w) = 480p_w$$
$$\overline{(200p_i + 300p_c + 400p_w)(1 + R') = 240p_i + 360p_c + 480p_w} \qquad (7')$$

We should expect the average rate of profits of equation system $(7')$, that is, R', to be greater than R simply because we have increased the total weight of the iron industry in the system, which has a higher rate of profits than the average R. However, from inspection, we can see that $R' = R* = 20\%$. And since we have already established that $R* = R$, it follows that all the es must be equal to zero. In other words, all the industrial rates of profit must be equal and equal to $R*$, that is, $r_i = r_c = r_w = R = R*$. Now we can plug the value of $r_i = r_c = r_w = R = R* = 20\%$ into equation system (6) and solve for prices. Thus we do not need the market mechanics and rational human behaviour to solve for prices in this case either—the required information to solve for the equation system could be found out by rearranging the data. In other words, the condition of a uniform industrial rate of profits is a structural property of the equation system.

Now let us introduce labour in the system explicitly and draw out a complete structural relation of any given system of production. We go back to Sraffa's original example of a three-commodity economy:

90 t. iron $+120$ t. coal $+60$ qr. wheat $+3/16$ labour $\rightarrow 180$ t. iron

50 t. iron $+125$ t. coal $+150$ qr. wheat $+5/16$ labour $\rightarrow 450$ t. coal

40 t. iron $+40$ t. coal $+200$ qr. wheat $+8/16$ labour $\rightarrow 480$ qr. wheat

This can be represented in price terms as:

$$
\begin{aligned}
\left(90p_i + 120p_c + 60p_w\right)\left(1+r\right) + 3/16\ w &= 180p_i \\
\left(50p_i + 125p_c + 150p_w\right)\left(1+r\right) + 5/16\ w &= 450p_c \\
\left(40p_i + 40p_c + 200p_w\right)\left(1+r\right) + 8/16\ w &= 480p_w \\
\overline{\left(180p_i + 285p_c + 410p_w\right)\left(1+r\right) + w} &= \overline{180p_i + 450p_c + 480p_w}
\end{aligned} \qquad (8)
$$

Converting it to its Standard counterpart, we get:

$$
\begin{aligned}
\left(120p_i + 160p_c + 80p_w\right)\left(1+r\right) + 4/16\ w &= 240p_i \\
\left(40p_i + 100p_c + 120p_w\right)\left(1+r\right) + 4/16\ w &= 360p_c \\
\left(40p_i + 40p_c + 200p_w\right)\left(1+r\right) + 8/16\ w &= 480p_w \\
\overline{\left(200p_i + 300p_c + 400p_w\right)\left(1+r\right) + w} &= \overline{240p_i + 360p_c + 480p_w}
\end{aligned} \qquad (8')
$$

Now, let us normalize our Standard net output to one, that is, put $\left(40p_i + 60p_c + 80p_w\right) = 1$, and call it the Standard commodity, which is our money-commodity. If wages are given in terms of this money-commodity, that is, as a proportion of the Standard net output, then we can derive the average rate of profits of this system for all the values of wages starting from zero to its maximum value $\left(40p_i + 60p_c + 80p_w\right)$, because the ratio of total profits to total capital remains in the Standard proportion and therefore can be determined without the knowledge of prices. This gives us a relationship between wages and profits, which is given by: $r = R*\left(1-w\right)$, where w is given in terms of the Standard net output and $R*$, which we have already derived from equation system (6′), is the maximum rate of profits of the system—it is the ratio of net output to total capital or the productivity of the system. This relationship between the productivity of the system and the rate of profits and wages is derived on the basis of the objective data without any knowledge of prices. Thus it is the fundamental structural property of the equation system. Since the Standard system is only a rescaled system of the actual system of observation, they are

algebraically equivalent systems, and therefore, the mathematical proper-
ties of the two systems must be identical too. In other words, the relation-
ship $r = R*(1-w)$ must also hold for the observed system, if the wages
and prices in the observed system are measured by the Standard commod-
ity as the chosen money-commodity. What we directly observe in the
Standard system in terms of physical data must show up to be true in the
empirical system in terms of its calculations in prices:

> 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. ... But the actual system con-
> sists 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 transpar-
> ency to a system and render visible what was hidden, but they cannot alter
> its mathematical properties. ... 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*.[28]

When we move wages from zero to their maximum value, we find that
as wages and the rate of profits change, the set of prices change too. But
these prices change only to ensure that for every given w, prices adjust in
such a way that the structural property of the equation system,
$r = R*(1-w)$, is satisfied throughout—that is, prices play the role of
accounting for the distribution of income, which is determined indepen-
dently of prices. Notice that when all the income goes to wages, then the
value of the net Standard output is equal to the value of the net output of
the observed system $\{(40p_i + 60p_c + 80p_w) = (165p_c + 70p_w)\}$, since in this
case the prices would be proportional to labour-values and both the sys-
tems use the same technique and one unit of labour to produce their
respective net outputs. For any other rate of wages, the values of observed
net output will not be equal to the value of the Standard net output.
However, the ratios of net output to total capital will remain constant with
respect to changes in prices throughout the variations of wages from zero
to its maximum value, as $R*$ is determined independently of prices.

In some sense, given wages, the average rate of profits determined by
the Standard system gives us the multiplication factor for homogenizing
capital, which appears to us as a heterogeneous collection of commodities.

[28] Ibid., 22–3.

As we have seen above, the procedure of homogenization of labour is dependent on the available objective data—it is simply a processing of proportions of total wage bills paid in various industries as proportions of total undifferentiated labour utilized in those industries. Similarly, homogenization of capital requires us to measure capital in such a way that profits received by capital turn out to be equal for every unit of capital in the system—that is, a return on the value of iron in each industry must be equal to a return on the value of coal and wheat when they are used as capital. This is possible only if returns on values of all commodities used as capital turns out to be equal to the average rate of profits of the system as a whole. The Standard average is the only average that can be distributed equally across the industries.

IV. Some Concluding Remarks

So, in the light of the above analysis, what are the aspects of classical and Marxian economics we must reject and aspects we rehabilitate? It is quite clear that Sraffa establishes that "profit is a non-price phenomenon." This is what Sraffa believed was the central aspect of classical economics and Marx. Adam Smith had clearly stated that wages and the rate of profits are determined in the dynamic context of history, and for any point of time, they are given "norms" and prices are determined by "adding up" the given distributional variables. In other words, it is the distribution of income that determines prices. In a letter to McCulloch, dated 13 June 1820, Ricardo wrote: "After all, the great questions of Rent, Wages, and Profits must be explained by the proportion in which the whole produce is divided between landlords, capitalists, and labourers, and which is not essentially connected with the doctrine of value."[29] In Sraffa's interpretation,[30] Ricardo had started off with the proposition that "it is the profits of the farmer that regulate the profits of all other trades," implying that in agriculture, both inputs and outputs can be treated as a single commodity—"corn." In this case, the rate of profits could be determined in physical terms independently of prices, and thus prices of all other commodities must adjust in such a way that all industries receive the same rate

[29] David Ricardo, *Works and Correspondence of David Ricardo*, Vol. VIII (Cambridge: Cambridge University Press, 1952), 194.
[30] Piero Sraffa, "Introduction", In *Works and Correspondence of David Ricardo*, Vol. I (Cambridge: Cambridge University Press, 1951).

of profits. It was the criticism by Malthus, who argued that "in no case of production, is the produce exactly of the same nature as the capital advanced. Consequently, we can never properly refer to a material rate of produce," that led Ricardo to abandon his "corn model" for the determination of the rate of profits and move to a general labour theory of value. Marx's theory of surplus value and his derivation of the rate of profits prior to the derivation of prices of production was also designed to show that profit is a non-price phenomenon. Sraffa's method of deriving the system's average rate of profits independently of prices, and then applying them to production equations to derive the prices follows Marx's procedure almost step by step, except that instead of deriving the production equations in terms of labour-values from the empirical input-output data, Sraffa derives the equations of his Standard system from the same input-output data. As Sraffa explains:

> There are besides, many possible applications {of the Standard commodity}, which I have not mentioned in the book, in problems discussed by Marx. Take, e.g. the determination of a general rate of profits, from the rate of surplus value: Marx takes an average of the rates of profits obtained in the production of the different commodities on the basis of 'values', and gets, as he acknowledges, an *approximately* correct result. An exact result could however be obtained by taking, instead of a simple average, a weighted average: & it can be shown that the appropriate weights can be derived directly from the proportions in which the comm{odities} enter the 'St{andard} com{modity}'.[31]

However, with the rejection of humanism of any kind, Sraffa removes the specificity of both the *human labour* and *rational human behaviour* from the centre of economic analysis. The importance of commodity residue as a central structural aspect of the economy clearly shows that the idea of reducing production to the primordial relation of man's *direct* action against nature must be rejected. This implies that neither labour is the ultimate cause of value nor productive technique can be reduced to a quantitative measure in terms of labour time alone. Marx's claim that only labour adds value to the commodity in the process of production is based on the notion that in the final analysis, labour is the only productive factor, which can only be established if commodity residue could be reduced to zero. For example, our equation system (6) solves for a finite positive rate

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[31] Piero Sraffa, *Sraffa Papers* (Cambridge: Wren Library), D3/12/111: 132, letter to Eaton dated 12 February 1961.

of profits and positive prices and is compatible with either wages put equal to zero or labour input put equal to zero. The classical approach would suggest that when wages are put to zero, the rate of profits must become infinite and Marx's approach would suggest that when labour input is put to zero, then the rate of profits must become zero. Clearly, both these approaches are incorrect. Hence, the idea that the source of profits is surplus value or exploitation of labour must be abandoned.

So, how to understand class struggle?[32] In Marx's context, class struggle is understood to be the progenitor of surplus product—the struggle over the length of the working day between the workers and the capitalists, given a wage basket, is the source of the surplus and this happens prior to the activity of production. To understand the nature of the difference between Sraffa's notion of surplus and Marx's, we need to clarify some technical issues first. In classical economics as well as Marx, wages are treated as a part of capital, an amount of money advanced to the workers prior to production. In Sraffa's equations, wages are not a part of capital advanced by the capitalists, but are rather a share in in the total net output, which is appropriated on the basis of the quantity of labour provided by the workers in a similar way as profits are a share of net output appropriated by the capitalists on the basis of the quantity of capital provided by the capitalists—class struggle plays out directly or indirectly in determining the rates of profits and wages, but the question of the length of the working day remains unproblematized. Thus, in Sraffa's framework, if we reduce the size of the economy by half, which would also reduce the labour time worked by the workers by half, it will not make any difference to the solution of the system of equations. However, in Marx's context, since the wage basket per worker is already determined as the value of the labour-power, reduction in the labour time worked by the workers would amount a rise in wages per hour of labour, which must lead to a fall in the rate of profits and changes in prices of production. So, from Marx's perspective, if we keep reducing the size of the economy, then we will hit upon a stage where all the net output is just equal

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[32] This section is inspired by a comment to an earlier draft of this chapter by Professor Geoffrey Harcourt, who wrote: "I have now read your essay on Marx's Labour theory of value…. I think it is a very clear statement of your arguments. I agree with all except your last conclusion. I think the LTV is a qualitative argument in terms of unequal power between the classes which explains the origin of profits in the sphere of production, prior to their realisation (or not) in the sphere of distribution and exchange. I still find that this illuminates understanding of the essential nature of capitalist dynamics." See GCH with Prue Kerr, "Marx, Karl Heinrich (1818–83)," in *International Encyclopedia of Business and Management*, ed. Malcolm Warner (London: Routledge, 1996), 3388–95.

to the wage advances, which is compatible only with zero rate of profits. This, in Sraffa's context, translates into wage per hour of labour rising to absorb the whole of net output, and therefore is compatible only with zero rate of profits and labour-value price ratios. If we treat these wages as parts of necessary inputs in the production equations as fuel for the machines or feed for the horses, then we get back our subsistence economy.

Does this contradict our definition of economic production as conversion of free energy from nature to a form of energy that has economic value? The answer is: no. If labourers, or for that matter, even animals, are used in the production process, then one can calculate the energy consumed by the labourers and the energy contributed by the labourers in the production process. If the two energies are equal, then there must be surplus production in the system. Now, think of reducing the contribution of the energy from the labourers to the production process such that the total energy used in the production (including the free energy from nature) becomes equal to the total energy consumed in the production process, including the total consumption by the labourers. This will give us the subsistence economy. Marx's argument appears to be that the surplus production from here on can only consist of getting more energy out of the labourer in the production process, and this is made possible only because capitalists wield power over workers, which shows itself on the factory floor. But surplus could also be produced by making the production process more efficient in the sense that it is able to convert more naturally available free energy to economic goods without increasing the human labour input. From this perspective, the labourer can be made redundant and the surplus could be explained simply by the technique of production. These are the two fundamental nodes on which the whole of "surplus" discourse rests on. Thus the class struggle that Marx talks about is real in the sense that stretching the labour time beyond a point, given subsistence wages, does contribute to surplus production, but it is not the only means by which a surplus can be produced. Efficiency gains on the use of any input of production, for example, if a machine could contribute the same energy to production by consuming less fuel or if it reduces waste of raw materials, and so on, would also contribute to surplus production. This explains why within capitalism, there is a tendency to stretch the working day as long as possible on one hand and, on the other, also replace labour by machines once machines become cheaper or more efficient to employ.

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