Value and price: a critique of neo-Ricardian claims*

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Introduction

The debate on the transformation of values into prices of production has generated an extensive literature, which space does not permit us to cover in its entirety. Instead, we present, in a condensed form, some analytical points that will be further developed elsewhere. We present a new approach which both 'solves' the problem and refutes the principal neo-Ricardian claims.

The first part recalls how the two essential propositions of the neo-Ricardian analysis are established: we show that what we call the 'steady state hypothesis' plays a central role and that without it, these two propositions cannot be established. In contrast, the logic of Marx's schemas is fully reconstituted. The second part advances a new reading of Marx, which shows that the error described by Bortkiewicz (1907) can easily be corrected without calling into question the validity of the chapter of *Capital* which deals with the transformation of values into production prices.

A critique of the neo-Ricardian model

Neo-Ricardians demonstrate 'the nonsensical character of the law of value'

The data of the problem. Neo-Ricardians begin directly with a description of the technical conditions of production, among which one may include the workers' consumption standards, which Sraffa (1960) does not do. As a starting point, we therefore have at our disposal a set of technical relations. These can be schematized with the help of a numerical example which avoids the use of mathematical formulae, without calling into question the generality of the reasoning:

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$240\ M_1 + 10\ M_2 + 200\ \text{labour} \rightarrow 500\ M_1$

$50\ M_1 + 20\ M_2 + 100\ \text{labour} \rightarrow 100\ M_2$

$90\ M_1 + 60\ M_2 \rightarrow 300\ \text{labour}$

These relations read as follows. During the single period of production under consideration

- 500 units of commodity M_1 are produced by means of 240 units of commodity M_1, 10 units of commodity M_2 and 200 units of labour;
- 100 units of commodity M_2 are produced by means of 50 units of commodity M_1, 20 units of commodity M_2 and 100 units of labour;
- Finally, the 300 total units of labour used require the consumption of 90 units of M_1 and 60 units of M_2.

With these basic data, it is possible to build two systems: the first one being prices of production (neo-Ricardian theory) and the second being values (Marxist theory).

The system of prices of production. We can transform the relations of production ($\rightarrow$) into equalities, after assigning prices to commodities:

- p_1 and p_2 are the prices of commodities M_1 and M_2, respectively;
- w is the wage (the price of a unit of labour).

The supplementary rule which is necessary to write down these equations is the existence of a uniform rate of profit R. Under these conditions, one obtains the following system of equations:

(1) $500\ p_1 = (1+R)\ (240\ p_1 + 10\ p_2 + 200\ w)$
(2) $100\ p_2 = (1+R)\ (50\ p_1 + 20\ p_2 + 100\ w)$
(3) $300\ w = 90\ p_1 + 60\ p_2$

This system can easily be solved and gives the following values for our example:

$$R = 25\%,\ p_1 = 10m/7,\ p_2 = 20m/7\ \text{and}\ w = m$$

where m is a parameter which can take any positive value; in other words, we get a system of *relative prices*.

A more detailed mathematical treatment of the problem shows that $1/(1+R)$ is the dominant eigenvalue of the matrix of unit technical coefficients obtained when the wage is replaced by its equivalent in commodities. The vector (p_1, p_2) of relative prices is the eigenvector associated to this eigenvalue. In the simple case examined here, where each commodity is produced by a single method of production, one can demonstrate that this solution is unique and is such that the rate of profit and all the prices cannot be negative. For this property to be established, a condition must be met, that can be interpreted in an economic way by saying that the economic system under study must at least ensure its self-reproduction.

That being said, the first important result of this calculation is that the knowledge of the conditions of production in the broad sense (that is to say, including the standards of consumption) is sufficient to determine the rate of profit and the relative prices.

The system of values. If we define the value of a commodity as the quantity of labour necessary (directly or indirectly) to produce it, then it is possible to build a system of values using the same data. The unknowns are v_1 and v_2, the values of the commodities M_1 and M_2. This system, which formalizes the Marxist theory of value according to the neo-Ricardians, is the following:

(1) $500\,v_1 = 240\,v_1 + 10\,v_2 + 200$
(2) $100\,v_2 = 50\,v_1 + 20\,v_2 + 100$
(3) $300\,v_f = 90\,v_1 + 60\,v_2$

The first two equations suffice to calculate values *by themselves*; in our example, they are $v_1 = 170/203$ and $v_2 = 360/203$. The third equation allows us, *in a second step*, to calculate the value of a unit of labour, which in our example is $v_f = 123/203$. This calculation allows us to distinguish 'variable capital' from 'surplus-value' and calculate the rate of surplus value as:

(unit value of output – unit value of labour)/unit value of labour $= (1 - v_f)/v_f = 80/203$

The new value created during the period ('variable capital' + 'surplus-value') is equal to 300, that is to say, the total expenditure of labour during this period. But it should be clear that this fact is already implicit in the way the system of values is written, and cannot therefore be interpreted as a result of this calculation.

Relationship between production prices and values. We can compare the two systems with the use of Table 1, showing the relevant aggregates and ratios.

This table shows that there is no way to pass from one column to another: this is a fundamental result because it helps us understand why it is fruitless to try and solve the problem by adding an additional rule. To assume, for instance, that the value of a particular commodity is by definition equal to its price, or choose as numeraire a commodity with a price equal to 1 by definition, is to use the degree of freedom that the parameter m allows. But such an attempt cannot in any way reduce the gap between the two rates of profit, since this discrepancy is independent of m. Postulating an equality between variables such as total profits and surplus value leads to the same impasse.

It is equally impossible to satisfy, at one and the same time, the previous equality – which here implies that $m = 120/203$ – and another equally significant equality between the two methods for calculating the value of total production, since this latter relation implies that $m = 121/203$.

It is, however, possible to extract from the system under consideration a sub-system defined by a uniform proportion between total production and total consumption of

Table 1. Two systems of calculation.

	Calculation in price of production terms	Calculation in value terms
Value of production	1000 m	121,000/203
Constant capital	500 m	60,100/203
Variable capital	300 m	36,900/203
Surplus value or total profits	200 m	24,000/203
Organic composition (%)	166.6	194.0
Rate of exploitation (%)	66.6	65.0
Rate of profit (%)	25.0	24.7

each commodity. In our example, this *standard system* is obtained by combining the entire industry producing M_2 and 4/5 of that producing M_1. In this case, the rate of profit calculated on the basis of the value system is exactly equal what we get from the price system, that is to say 25%. But it remains evident that the existence and properties of this standard system do not call into question the conclusions that the neo-Ricardians draw from a study of the model presented here.

Two fundamental neo-Ricardian claims. These two central claims can be summarized as follows:

(i) For knowledge of the conditions of production in the broad sense (including the norms of consumption) lets us calculate, in two different ways, a system of relative prices and the rate of profit, and a system of values, respectively.

However, as Napoleoni (1972), cited by Benetti (1974), insists, 'Instead of the transformation of values into prices, we obtain a scheme which determines prices independently from values'.
*The prices of production are not transformed values* and, a fortiori, the theory of value cannot claim to account for the determination of the rate of profit.

(ii) *There does not exist – except in special cases – any way to get from values to prices of production*, that is to say, any relation between the relevant variables or rates. In particular, total profit, expressed in prices of production, cannot be connected to the mass of surplus value produced during the period. The Marxist theory of surplus value as source of profit is not only unnecessary but also wrong.

In view of these results, it is perfectly legitimate to conclude as do the collective authors of 'Value, Price and Realization' (*Auteur collectif* 1976–1977) that

Consequently, if by 'law of value' we understand a law according to which the prices of production of the commodities and social profit are directly or indirectly determined by the labour content of these commodities, then we are asserting a nonsense.

These propositions can be summarized by means of the following diagram, where the double vertical line indicates the impossibility of a passage from one system to the other.
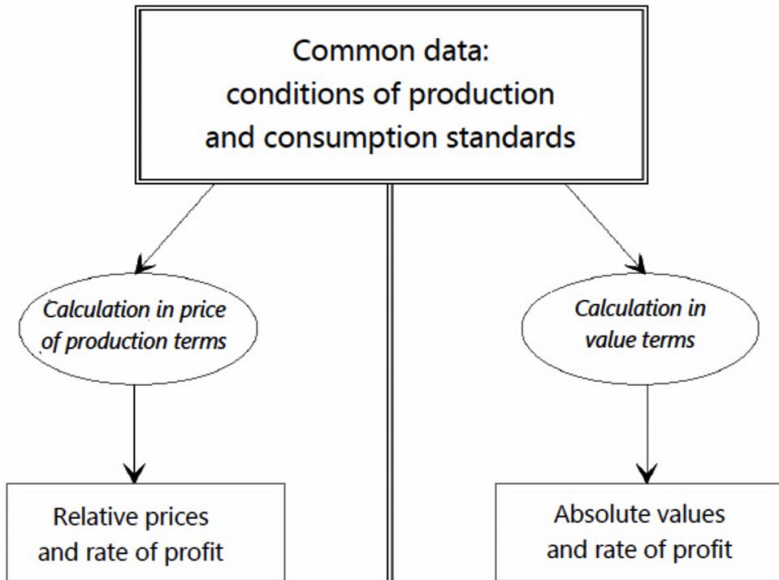
A critique of neo-Ricardian claims

The central neo-Ricardian hypothesis

However, the following hypothesis, which is nowhere stated, is needed in order to write down the equations of the system of prices of production. Recall the first of these:

(1) $500\ p_1 = (1 + R)\ (240\ p_1 + 10\ p_2 + 200\ w)$

The way that the data (in terms of the relations of production) are translated into this equation is the central problem of the neo-Ricardian approach. The underlying assumption is apparently harmless and has never been discussed in a systematic manner.

To write this equation down, it is in fact necessary to give the same price p_1 to the 240 units of M_1 used up in production, and to the 500 units of this same good produced during the same period. More generally, the price system that valorizes the inputs must be the same as that used for the outputs. If this were not the case, if the prices for output p'_1 and p'_2 were different from those of inputs p_1 and p_2, we would obtain the following system of equations:

(1') $500\ p'_1 = (1 + R)\ (240\ p_1 + 10\ p_2 + 200\ w)$
(2') $100\ p'_2 = (1 + R)\ (50\ p_1 + 20\ p_2 + 100\ w)$
(3' $300\ w = 90\ p_1 + 60\ p_2$

Such a system, where input prices and output prices are different, cannot be solved without additional information: there are in fact only three relations for six

unknowns (p'_1, p'_2, p_1, p_2, w and R). Even if we content ourselves with relative prices, this is insufficient. The Neo-Ricardians out of hand shrug off this problem by implicitly postulating that $p_1 = p'_1$ and $p_2 = p'_2$. This rule, which seems obvious to them, implies in fact a very strong assumption that we shall call, in what follows, the *steady state hypothesis*.

This conforms to neo-Ricardian logic, in which the data in terms of conditions of production are sufficient to determine the system of prices. However, for a given period of production, *the prices of the inputs are the prices of the outputs of the previous period*, if we consider a single period of production. If these prices are identical, this necessarily implies that the conditions of production were also the same during the previous period. In other words, it is justified to speak of a steady-state hypothesis because the conditions of production are invariant; it is clear that this assumption plays a decisive role for the coherence of the neo-Ricardian system. In a more formalized way, the neo-Ricardian construction can be summarized as follows:

$$\{H1, H2, H3\} \rightarrow P$$

with H_1: price of inputs = price of outputs

H_2: single period of production

H_3: uniformity of the rate of profit.

The proposition that follows from these assumptions can be written as

$$P: D \rightarrow p, R$$

The prices and the rate of profit can be determined by the knowledge of the relations of production alone. However, except in mathematically complex and economically meaningless special cases, the proposition P can only be checked if H_1 also implies the identity of the relations of production in the period t and the previous period t – 1. Otherwise, there would obviously be a conflict between P and H_1. It is this equivalence that we call steady-state hypothesis (HSS), so that neo-Ricardian reasoning can be formalized as follows:

$$\{HSS, H2, H3\} \rightarrow P$$

Some remarks on the steady-state hypothesis

This assumption should be characterized as follows, without substantively modifying its implications: the conditions of production can change while the associated system of prices remains the same. In mathematical terms, this means that the matrix of technical coefficients for two consecutive periods has the same dominant eigenvalue, and the same associated eigenvector. This is a very special case; merely stating it shows that it has no economic significance and that it would be perfectly absurd to take it as a hypothesis.

One way to render the steady-state hypothesis apparently less restrictive would be to assume that the conditions of production can change while leaving unchanged the

internal proportions of the model. We are then dealing with 'balanced growth' where everything grows at the same rate and where, by hypothesis, relative prices remain unchanged from period to period. But this is a completely artificial procedure, insofar as it is strictly equivalent to a uniform change in the units used for measuring the quantities of goods.

The steady-state hypothesis is extremely strong: logically, it must be extended not only to the case of two consecutive periods but to an infinite number of periods. This finding is nevertheless not new: 'Morishima (1973) has shown that this synchronic definition of values gives identical results to those obtained by adopting a diachronic definition, being subject to a very strong assumption, the invariance of techniques in time'. (*Auteur collectif* 1976–1977). We find the same observation in Benetti's analysis – directly inspired by Sraffa – which consists of 'reducing' the quantities of goods to 'dated quantities of labour'. This procedure is nothing other than an algorithmic restatement of the price system (which Benetti does not seem to notice) and clearly establishes that the steady-state hypothesis has to be extended to an infinity of periods.

Although it has never been questioned, the steady-state hypothesis cannot be considered as a legitimate 'simplification', if only because it is methodologically absurd. The problematic proposed by the neo-Ricardians implies that the prices of production are taken to be the unknowns of the problem, while it is known in advance that they will not have changed an inch compared to any previous period! This reason alone would be enough for rejecting the steady-state hypothesis. It amounts to reasoning as if the period of production was infinitely short or, strictly speaking, instantaneous, so that it becomes legitimate to assume equality between prices 'at the beginning of the period' and prices 'at the end of the period'. We find again the well-known problematic of 'equilibrium': on this fundamental point, the neo-Ricardian construction does not break with the 'approximations' and the 'methodological *coups de force*' so dear to the neoclassicals, that is to say to vulgar economics.

The consequences of dropping the steady-state hypothesis

To investigate properly what happens when we give up the steady-state hypothesis, we have to consider a sequence of two consecutive periods. The first period is defined here by the following set of data.

Period 1

$$192 \ M_1 + 24 \ M_2 + 240 \ \text{labour} \rightarrow 400 \ M_1$$

$$30 \ M_1 + 60 \ M_2 + 60 \ \text{labour} \rightarrow 300 \ M_2$$

$$90 \ M_1 + 180 \ M_2 \rightarrow 300 \ \text{labour}$$

In the second period, the conditions of production change. It is further assumed that the workers' consumption consists of goods produced in the previous period, so that the inputs of period 2 are the outputs of period 1 (400 of M_1 and 300 of M_2). The data for period 2 can be written as follows.

Period 2

$$220 \ M_1 + 20 \ M_2 + 200 \ \text{labour} \rightarrow 500 \ M_1$$

$$50 \ M_1 + 150 \ M_2 + 125 \ \text{labour} \rightarrow 625 \ M_2$$

$$130 \ M_1 + 130 \ M_2 \rightarrow 325 \ \text{labour}$$

Properties of period 1. Maintaining the steady-state hypothesis, the systems of prices of production and values lead to the following solutions:

$$p_1 = 3m, \ p_2 = m, \ R = 25\%, \ v_1 = 6/5, \ v_2 = 2/5$$

We can therefore verify that prices and values are proportional and that the transformation problem does not appear. Our numerical example was obviously built to give such a result. In other words, the deviation of values relatively to prices of production can happen in period 2 only if we give up the steady-state hypothesis.

Under these conditions, the steady-state hypothesis clearly appears for what it is, namely, a methodological obstacle to the correct study of the transformation problem. In the special case of our period 1, it is obvious that the prices of outputs are equal to values, for m = 1. This equality cannot be established without a common unit which is naturally labour time. This period serves only to provide a starting point built so as to be neutral with respect to the problem of transforming values into prices.

Study of period 2. Once we give up the steady-state hypothesis, the problem is posed in different terms: the prices and the values of goods produced in period 1 are known and are part of the data for the problem under consideration. But we cannot assume that the prices of the current period will remain the same because the conditions of production have changed. We then have a new list of unknowns relating to this period, which we denote by p'_1, p'_2, v'_1, v'_2, R'. We can now write the system of prices of production as follows

$$500 \ p'_1 = (1 + R') \ (220 \ p_1 + 20 \ p_2 + 200 \ w')$$

$$625 \ p'_2 = (1 + R') \ (50 \ p_1 + 150 \ p_2 + 125 \ w')$$

$$325 \ w' = 130 \ p_1 + 130 \ p_2$$

Replacing p_1 and p_2 by their known values, we end up with the two equations below

$$p'_1 = 4/5 \ (1 + R') \ \text{and} \ p'_2 = 8/25 \ (1 + R')$$

from which we can only calculate relative prices: $p_1/p_2 = 5/2$, while the rate of profit R' is for its part completely indeterminate. We thus obtain our first main result.

Dropping the steady-state hypothesis renders the neo-Ricardian system of prices of production incapable of determining the rate of profit.

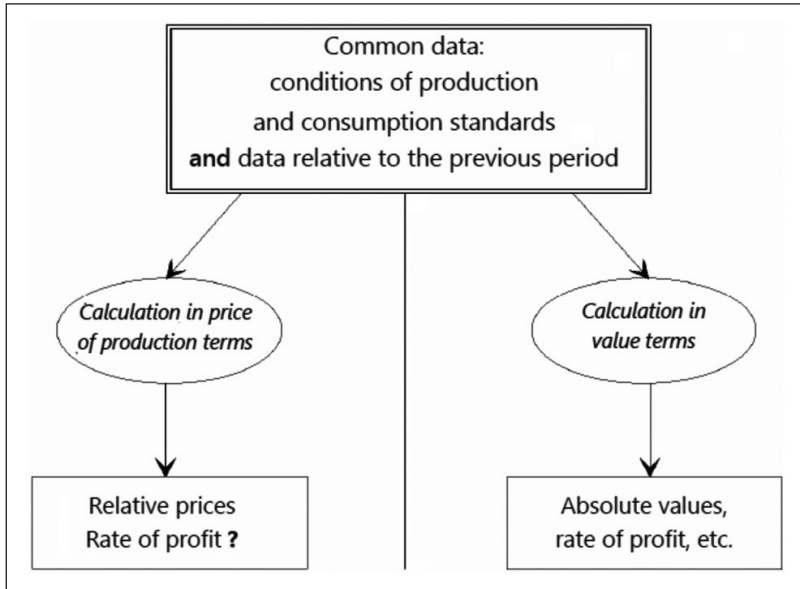The value system can be written as follows:

$$500 \, v'_1 = 220 \, v_1 + 20 \, v_2 + 200$$

$$625 \, v'_2 = 50 \, v_1 + 150 \, v_2 + 125$$

$$325 \, v_f = 130 \, v_1 + 130 \, v_2$$

We know that $v_1 = 6/5$ and $v_2 = 2/5$ since these are given data, so we can easily calculate $v'_1 = 0.944$; $v'_2 = 0,392$; $v_f = 0.64$; $e = (1 - v_f)/v_f = 0.5625$

We check in passing that the values do indeed deviate from the prices of production: v_1/v_2 is approximately 2.4 while p_1/p_2 is exactly 2.5.

At this point, we get a new diagram comparing calculations in terms of prices of production and in terms of value.

Here, the data comprise the relations of production *plus* the data (prices and values) from to the previous period, in distinction from the neo-Ricardian scheme which assumes a priori, through the steady-state hypothesis, that prices and values are identical whether they are inputs or outputs. We can confirm that the calculation in terms of values can be carried out to completion, that is to say, all significant variables and ratios are determined. This is not the case for the calculation in terms of prices, which determine only relative prices, and leave both the rate of profit and the absolute magnitude of prices indeterminate. We obtain a new diagram, where the vertical line that separates the two methods of calculation now has an entirely different meaning: it marks, at this stage of reasoning, the dividing line between two modes of calculation, the first being complete, while the second remains unfinished. The problem of the passage from one calculation to the other, that is to say the transformation problem, is then posed in completely different terms.

Transformation of values into prices

It now becomes possible to reinstate the real logic of the Marxist transformation sche-mata, according to which prices of production are values transformed by the process of equalization of surplus value. The basic relationship here is the equality between newly created value and total labour time expended. This equality is not a property to be veri-fied a posteriori, but expresses the basic principle that the magnitude of total profit does not depend on its distribution among individual capitals but is determined by total surplus value. This equality can be written, for our example:
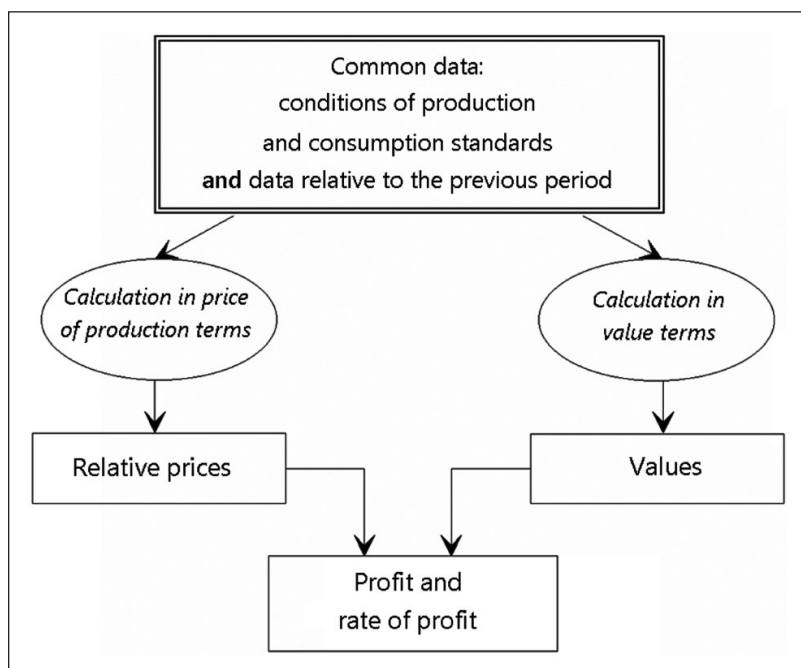
$$500 \; p'_1 + 625 \; p'_2 - 392 = 325$$

created value = total labour time

And the system of prices of production can now be written as follows:

(1) $500 \; p'_1 = (1 + R') \; (220 \; p_1 + 20 \; p_2 + 200 \; w')$
(2) $625 \; p'_2 = (1 + R') \; (50 \; p_1 + 150 \; p_2 + 125 \; w')$
(3) $325 \; w' = 130 \; p_1 + 130 \; p_2$
(4) $500 \; p'_1 + 625 \; p'_2 - 392 = 325$

   A complete solution can be this time obtained: $p'_1 = 0.956 \; p'_2 = 0.3824 \; R' = 19.5\%$ and the resulting diagram can be drawn as follows.

This schema, in contrast to the neo-Ricardian framework, shows that giving up the steady-state hypothesis invalidates the two propositions that this hypothesis helped to establish and restores the fundamental propositions of Marx's analysis. We can summarize all of the above with Table 2.

Table 2. Neo-Ricardian framework and steady-state hypothesis.

Neo-Ricardian framework	Giving up the steady-state hypothesis
Proposition 1: given the relations of production, it is possible to solve separately the system of relative prices with the rate of profit, and the system of values. *Prices of production **are not** transformed values.* Proposition 2: except in special cases, there is no passage from values to prices of production, and no link between the relevant variables or ratios of the two systems.	Proposition 1: given the relations of production and the data relative to the previous period, it is not possible to determine the magnitude of profit or the rate of profit with a calculation in terms of prices of production. But it is possible to solve the system of values. Proposition 2: the complete resolution of the system of prices of production requires the use of the equality between value created and total labour time. *Prices of production **are** transformed values.*

Restoring Marx's schema

We can go a little further and show that by giving up the steady-state hypothesis, we arrive precisely at Marx's own calculations. At the beginning of period 2, the relations of production and the values of goods produced in period 1 are known. These data allow us to reconstruct a table of calculations similar to that which Marx exhibits in *Capital*.

In branch 1, constant capital is $220v_1 + 20v_2$. Since $v_1 = 6/5$ and $v_2 = 2/5$, it represents a value of $C_1 = 272$. Similarly, we can calculate C_2, the constant capital of industry 2, which is 120. The total quantity of labour is equal to the total value created during the period, which can be divided into variable capital (V) and surplus value (PL). We therefore have $V_1 + PL_1 = 200$ and $V_2 + PL_2 = 125$. The distribution between surplus value and variable capital can thus be calculated on the basis of the consumption data. We get $325v_f = 130v_1 + 130v_2$. v_f is therefore equal to 0.64. The rate of exploitation (PL/V) is equal to $1 - v_f/v_f = 0.5625$.

From these elements, we can draw up Table 3.

Table 3. Restoring Marx's schema.

Industry	[1] C	[2] V	[3] PL	[4] Rate of profit	[5] Average profit	[6] Price of production	[7] Quantity produced	[8] Unit price
1	272	128	72	19.5%	78	478	500	0.9560
2	120	80	45	19.5%	39	239	625	0.3824
Total	92	208	117	19.5%	117	717		

Let us make some comments on this table:

a) The first three columns represent *the data of the problem, where no physical quantity appears as such*. The transformation process will take place in so far as the organic compositions are different, that is to say, in our example, because 272/128 is different from 120/80. But this criterion does not depend upon a relationship between physical quantities and there is no reason for them to be part of the data of the problem.

b) The next three columns correspond to the classic pattern: the general rate of profit is calculated by comparing the total surplus value, here 117, to the total capital C + V, here 392 + 208. The rate of profit is therefore 19.5%. This general rate is then applied to the capital advanced in each industry to calculate the price of production, by adding the average profit to the capital (which is equal to the cost of production, since there is only circulating capital). We note that the transformation process depends on the total value of the product of each industry.

c) At this point, we can introduce, *as additional data*, the physical quantities of production and calculate the unit prices in the last column. We obtain, for example, 0.956 = 478/500 for industry 1.

We have therefore restored the calculation scheme proposed by Marx. Since the starting point was precisely the 'error' discovered by Bortkiewicz, we must now go back to the sources, in this case the relevant chapter of *Capital*.

Rereading Marx

This is how Bortkiewicz summarizes the error he attributes to Marx:

> It is easy to show that the procedure employed by Marx for the transformation of values into prices is erroneous, since it fails to keep separate rigorously enough the two principles of value- and price-calculation […] In transforming values into prices, it is inadmissible to exclude from the recalculation the constant and variable capital invested in the various spheres of production. (Von Bortkiewicz 1907)

We have to therefore refer to Chapter IX of volume 3 of *Capital* and extract the two main passages where Marx refers to this problem:

> (i) The distinction is rather this. Apart from the fact that the price of the product of capital B, for example, diverges from its value, because the surplus-value realized in B is greater or less than the profit added in the price of the products of B, the same situation also holds for the commodities that form the constant part of capital B, and indirectly, also, its variable capital, as means of subsistence for the workers.

> As far as the constant portion of capital is concerned, it is itself equal to cost price plus surplus-value, i.e. now equal to cost price plus profit, and this profit can again be greater or less than the surplus-value whose place it has taken. As for the variable capital, the average daily wage is certainly always equal to the value product of the number of hours that the worker must work

in order to produce his necessary means of subsistence; but this number of hours is itself distorted by the fact that the production prices of the necessary means of subsistence diverge from their values.

However, this is always reducible to the situation that whenever too much surplus-value goes into one commodity, too little goes into another, and that the divergences from value that obtain in the production prices of commodities therefore cancel each other out. With the whole of capitalist production, it is always only in a very intricate and approximate way, as an average of perpetual fluctuations which can never be firmly fixed, that the general law prevails as the dominant tendency. (Marx [1894] 1993: 261)

(ii) 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 is 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. Our present investigation does not require us to go into further detail on this point. (Marx [1894] 1993: 265)

The first quote deals with Bortkiewicz's exact point. The first part of Marx's answer can be found at the end of this passage where he speaks of 'dominant tendency' that prevails 'in a very intricate and approximate way, as an average of perpetual fluctuations'. If such was Marx's answer, it would be clearly worthless because it is methodologically inconsistent. His formulation relates to the tendency towards the formation of a uniform general rate, which is indeed a tendential law. But in the theoretical model, such fluctuations are a priori excluded and Marx considers a uniform rate of profit. In other words, this sentence on fluctuations can be interpreted in two ways:

One can suppose that Marx attempted to solve the difficulty of processing elements of capital by using a concept – market prices fluctuating around prices of production – which remains outside the methodological framework within which this difficulty arises. In this case, the response falls completely flat.

Or, one can suppose that Marx begins to talk about something else: the proposition that the equalization of the rates of profit is a tendential law which in this case is misplaced. Since volume III is a draft and not a final version of the writing of Marx, this interpretation is plausible; the sentence in question could be a simple reminder of a point to develop and should not be read as the conclusion of the previous paragraph.

We will leave here this hazardous exegesis and simply stress that if this is Marx's solution, then it does not answer the question. However, Marx's text contains another element of the answer, whose meaning is quite different. Let us reread the beginning of the quote and pause on this sentence:

As far as the constant portion of capital is concerned, it is itself equal to cost price plus surplus-value, i.e. now equal to cost price plus profit, and this profit can again be greater or less than the surplus-value whose place it has taken.

This sentence should be emphasized several times. The substance of what Marx says is that the *constant capital is equal to the cost of production plus profit*. This does not seem to us to be a forced interpretation of the sentence, especially since Marx says, 'i.e. now equal to cost price plus profit'; this 'i.e. now' cannot mean something other than 'now that we are studying the transformation of values into prices of production'. In this case, the constant fraction is accounted for by adding the profit, and not the surplus value, to the cost of production; in other terms, *constant capital is expressed in terms of prices of production*.

What follows in the passage shows that the same holds for variable capital: 'this number of hours is itself distorted by the fact that the production prices of the necessary means of subsistence diverge from their values'. Here again, Marx clearly explains that variable capital is expressed in production cost, in other words that it is 'distorted' with regard to a calculation in value.

Let us now comment on the second quoted passage. Marx recalls the 'modified significance of the cost price', which comes from the fact that the production cost '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'.

We find the same statement here: the production cost, in other words the sum of constant capital and variable capital, is itself already transformed into prices of production and therefore can be above or below its value. Immediately after, Marx repeats the same proposition: 'it is always possible to go wrong' when 'the cost price of a commodity is equated with the value of the means of production used up in producing it', in other words with its value.

This interpretation shows that Marx clearly sees that constant and variable capital are expressed in prices of production but that this point is non-essential to him: 'Our present investigation does not require us to go into further detail on this point'; we must remember that Marx is currently trying to show how the transformation of values into prices can render the law of value compatible with the equalization of profit. And the first part of our study has shown that the calculation tables proposed by Marx would fulfil the same function, had he explicitly stated that constant capital and variable capital are expressed in prices of production, *since the transformation process has taken place during the previous period*, and should not interfere with the study of the current period. This precision, as was shown before, does not affect the validity of his scheme.

Two points must however be clarified. The first deals with the meaning of the rate of surplus value which undergoes a slight transformation here. To make things clearer, let us consider the ratio between variable capital and the new value created, which can be written $1/(1+e)$, where e is the rate of surplus value. The new value created is equal to total labour time and is not affected by the transformation process. On the contrary, the variable capital being by definition expressed in terms of output prices, this ratio differs from the same ratio calculated in terms of values, since the prices of the means of subsistence differ from their values. However, as we have seen above, this point is indicated correctly by Marx.

If we keep in mind this difference in the calculation of the rate of surplus value, we can make the computations described in Marx's schemas in exactly the same way as him.

It is however necessary to make some terminological changes. The title of the column in Marx's scheme, 'value of commodities' (Marx [1894] 1993: 256), is a misnomer since production costs are already transformed into values, and it would be therefore better to speak, for instance, of values before transformation.

The second point of clarification follows from the above: it deals with the two fundamental equalities. The first, between surplus value and profit, is guaranteed because it is not a result of the calculation, but indeed a part of the method of calculation. The second equality, between the sum of values and the sum of prices of production, is also preserved if we recognize these to be the 'values before transformation'. So the reproduction schemes are fully validated, if it is assumed that the elements of constant and variable capital themselves have been previously submitted to the transformation process.

If we drop Bortkiewicz's 'correction', we can confirm that this is exactly what Marx sought to clarify in the passages quoted above. And even if this interpretation of his text is wrong, it remains no less true that this is the simplest answer to the Bortkiewicz's objection. Basically, it is the uncritical acceptance of the steady-state hypothesis that, from our point of view, has obstructed this result being made clear.

Conclusion

1. The comparison between the neo-Ricardian system and our reading of the chapter of *Capital* on transformation has allowed us to specify the framework used by the neo-Ricardian for their critique of Marx. Its two main features are an incoherent formalization of the circulation of capital, and its formalization of the concept of unit price.

The circuit of capital

The neo-Ricardian approach is supposed to deal with a discrete period of production whose length is not null, and thereby differ from Walrasian General Equilibrium, characterized by the lack of a time dimension and therefore unable to produce a consistent theory of capital. At the beginning of the period, there are quantities of goods and labour, which are combined for the production of a variety of goods at the end of the period of production. But this notion of period cannot claim to represent, even in a simplified way, the circuit of capital unless it leaves open the possibility of considering a sequence of successive periods linked by the fact that the outputs of any period become the inputs of the subsequent period.

Neo-Ricardian theory can be 'closed' only by assuming that any period is equivalent to any other, past or future. This theory can certainly describe a sequence of periods of production, but only in one case, where they are indistinguishable from the point of view of prices and the associated rate of profit. The identity between prices of inputs and outputs is indeed a necessary property, so that the distinction between successive periods is totally formal and is equivalent to assuming that the duration of the period of production is null or infinitely small.

Insofar as a mathematical formalization is used, the implications of such a property cannot be understated. The neo-Ricardian model must therefore answer to the most absurd of them. For sure, they demonstrate irrefutably that Marxist theory is entirely

wrong (and also superfluous) – but by using a model in which blast furnaces exist for all eternity, while prefabricated houses have been built with the same methods of production for millennia. Under such conditions, the conclusion is that this formalization has not really escaped from the Walrasian framework because the circuit of capital is treated in a purely formal manner. It can be shown, though we will not do so here, that Sraffa's system is compatible with Walrasian General Equilibrium and is in fact a subset of this approach.

The concept of unit price

One of the major differences between Marx's scheme and the neo-Ricardian model is that the latter includes physical quantities and that unit prices play a central role. This feature is clearly a corollary of the steady-state hypothesis. With this hypothesis, the prices of inputs cannot be known prior to the production process because the same set of prices must apply both to inputs and outputs, and depends on the conditions of production defined in terms of physical quantities.

If instead we leave aside the steady state hypothesis, we find ourselves in a less paradoxical scenario: when a capitalist buys a quantity of raw materials at the beginning of the period of production, he knows what price he will have to pay, and therefore knows the magnitude of his advanced capital. These data are known before the production process takes place, whereas in the neo-Ricardian scheme, they are, bizarrely, determined only at the end of the production process. It is thus not possible to disconnect the act of purchase of means of production from the sale of the product: once again, we find that, in this scheme, the duration of the period of production must be null. If on the other hand it is assumed that the amount of capital invested is known at the beginning of the period of production, which implies giving up the neo-Ricardian schema, the process of transformation is regulated by the organic composition of each branch: it does not depend on physical quantities as such, which are used, but only subsequent to the transformation, to fixing the absolute level of unit prices.

These observations help us to understand why the neo-Ricardian system is determined in terms of relative prices and cannot therefore be related to values expressed in absolute quantities of labour. This difference has sometimes led to the conclusion that prices and values are incommensurable, but it is only a by-product of the steady-state hypothesis which is required so that prices of production can be computed independently of any reference to values.

If we abandon this hypothesis, the problem is overturned: prices and values have to be commensurable, since the only way to 'close' the model is to determine prices as transformed values. Under these conditions, there can be no incommensurability: the prices of production, like values, are expressions of quantum of labour and are always related to an individual capital or industry, not to a physical product. The transformation process serves to reallocate the mass of surplus value produced by different capitals: this process is not based on the quantities produced, but only on the total mass of value produced.

In our opinion, these brief remarks indicate that it is not possible to restore the foundations of Marxist theory against the neo-Ricardian critique without identifying the central role of the steady-state hypothesis and questioning it.

2. We will not review here the numerous attempts, in line with Sweezy (1942), that use special assumptions and thus only solve half the problem, that is to say they do not solve it at all: none of them really challenge the neo-Ricardian propositions outlined above. It is however germane to consider the 'answer' given by Benetti, expounded in particular in his book *Economie classique, économie vulgaire* (Benetti et al. 1975), that can be summarized as follows: 'What is objectionable is the simultaneous inclusion of the concepts of value and price in the logical framework of an economic model' (pp. 127–128). This position is not sustainable for three reasons:

   a) The first reason is that this distinction between the 'field of values' and the 'field of prices', to use Lipietz's terminology, is a misinterpretation of the articulation of these two concepts in Capital. Yaffe has a much better understanding of it when he writes,

   The price of production is an 'intermediary link' between the immediate process of production and the forms of appearance of surplus-value as ground rent, profit and interest. Marx does this in stages. He first deals with the production of value and surplus-value in the direct process of production. When he moves on to consider in Volume III, profit and the rate of profit – the form in which surplus-value presents itself in view – he takes this process as given. (Yaffe 1974)

   The error made by Benetti could easily lead to the logical conclusion that volume III of *Capital* should be considered entirely to lie 'in the field of political economy', while the critique of political economy is confined to volume I.

   b) The same position, more or less, is adopted by Dostaler (1978) in his book *Marx, la Valeur et l'Economie politique*. A similar view can be found in Bompard and Postel-Vinay's (1975) article for *Les temps modernes*: it is very significant to see how these two authors, in their review of Gutelman's *Structures et réformes agraires*, 'play' Bortkiewicz and Benetti against the very foundations of the theory of absolute rent developed in volume III of *Capital*. A new 'epistemological break' is now located at the end of the first volume of *Capital*!

   c) Finally, from the point of view of the ideological struggle, the position of Benetti has the effect of conceding, or at least leaving the field open, to those like Joan Robinson (1942) for whom the Marxist theory of value is 'metaphysics'. Indeed, a theoretical construction can be rightly labelled metaphysical if it does not allow mediations to replicate the real-concrete and, on the contrary, builds insurmountable barriers between the theory and its object. Therefore, when Samuelson (1970), with presumptuous vulgarity, explains that the transformation of values into prices can only be achieved by means of an eraser,[9] Benetti can only oppose to this a distinction between concrete labour (Sraffa's scheme) and abstract labour (Marx's scheme). But the bourgeois economist is fully satisfied with a system of prices, a rate of profit and quantities of concrete labour.

3. Our object of study is 'upstream' of contributions like those of Yaffe and Salama (1975) that are profoundly relevant. Its first aim was to show how the key claims

of the neo-Ricardian model are strictly dependent on what we call the steady-state hypothesis. The next objective was to explain how it is possible, by giving up this completely illegitimate hypothesis, to restore Marx's results and suggest a new understanding of his schemata for the transformation of values into prices, free from Bortkiewicz's alleged 'error'. The critique of neo-Ricardian theses developed in this article is thus partly internal, inasmuch as it accepts – deliberately and knowingly – staying inside the methodological framework used to establish their claims.

That said, until now answers to the neo-Ricardian critics have basically said something like 'You show that the Marxist theory of value and prices of production is wrong, but we reject this result because your analytical framework is itself alien to Marxist methodology'; however, the criticism developed here makes it possible to take a much stronger position by using the following language: 'If we accept the framework of your model and if we generalize it by removing the steady state hypothesis, it becomes obvious that your propositions can no longer be established and that, instead, the theory of value is needed'.

It is at this moment, and at this moment only, that it becomes possible to add, 'Moreover your analytical framework is inadequate to a correct understanding of the reality of the capitalist mode of production'. So the accusation of being 'metaphysical' can be avoided and it is now possible to develop the arguments of Yaffe and Salama which, hitherto, could only cover the methodological framework of their opponents, leaving untouched the results produced inside it.

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