A NOTE ON
ORGANIC COMPOSITIONS OF CAPITAL AND
THE LABOR THEORY OF VALUE

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Competition does not reduce commodities to their value, 
but to their cost price, which is above, below, or equal 
to their value, according to the organic composition of 
the respective capitals.  
Marx to Engels, August, 1862. 

I. Introduction

It has long been believed that deviations of prices from embodied 
labor values are ‘systematically predictable’ in the sense that prices will 
exceed values for those commodities whose organic compositions of capital 
exceed the social average organic composition of capital while prices will 
fall short of values for those commodities with organic compositions of 
capital that are less than the social average. This view is contained, 
most notably, in the works of Ricardo, Mill, and Marx, although the 
terminology differs between one author and another (throughout this paper I 
employ Marx’s terminology). Neither Ricardo, Mill, nor Marx, however, held 
in their grasp the analytical tools necessary to decisively establish the 
truth of the proposition in a logically coherent manner. As a consequence, 
this Ricardo-Mill-Marx conjecture (RMM), as it were, has hung suspended in 
a logical limbo for over a century. Fortunately, recent developments in 
the Classical theory of value, launched by Sraffa’s Production of 
Commodities by Means of Commodities, make it possible to settle the 
question. In short, the RMM conjecture is false. Although this appears to 
have been taken for granted in the ‘Marx after Sraffa’ literature, it has 
never been formally demonstrated. The objective of this paper is to do 
precisely that in the context of a simple Sraffian model.
We shall begin by considering the reasons why the RMM conjecture has seemed so plausible to so many generations of value theorists. We then present a lethal counter-example and finally consider the significance of the result for the labor theory of value.

2. Deviations of Prices from Values

As is well known, prices cannot in general equal values unless rates of profit or rates of exploitation differ across different branches of production. Equality of rates of exploitation obtains from assuming equality of the real wage for all workers. Equality of rates of profit is assured by competition among capitals. Hence, the 'naive' labor theory of value which equates prices and values seems logically untenable except in the most exceptional of cases.

This is easily illustrated using the usual Marxist notation. Consider, if you will, several branches of production whose value compositions are

\[ c_i + v_i + s_i = w_i , \quad i = 1, 2, \ldots, n. \]

If prices were equal to values, the rate of profit in each branch of production would be

\[ R_i = s_i / (c_i + v_i) = (s_i / v_i) / [c_i / v_i + 1] \]

Since \( s/v \), the rate of exploitation, must be the same in every industry if the real wage is the same, rates of profit will be equal if and only if \( c/v \), the organic composition of capital, is the same in every industry. Indeed, rates of profit would be highest in those branches of production with the lowest organic compositions of capital, and \textit{vista verna}.

Now, as a general theoretical principle, equality of organic compositions of capital in all branches of production was unacceptable to
Ricardo, Mill, and Marx, and each was attracted to the following line of argument, which is the rational foundation of the RMM conjecture: Since the rate of profit is highest in the production of those commodities whose organic compositions of capital are lowest, a lowering of their prices would move the rates of profit in their production in the direction of a socially average rate of profit. A rise in the prices of commodities with high organic compositions of capital, on the other hand, would raise their rates of profit toward the same socially average rate of profit. It seems to follow that equality of the rate of profit in all branches of production could be achieved if the prices of commodities whose organic compositions of capital were less than some critical proportion (the socially average organic composition of capital) were to be lowered and if the prices of commodities whose organic compositions of capital were greater than the social average were raised. On the basis of arguments similar to this one, Ricardo, Mill, and Marx believed that the prices of commodities with low organic compositions of capital will be less than their values and that the prices of commodities with high organic compositions of capital will be greater than their values. Hence the claim that deviations of prices from values are predictable on the basis of organic compositions of capital.

This argument, as left to us by our Classical masters, has two chief inadequacies. The first is that the 'socially average' rate of profit and organic composition of capital are left undefined. The second is that adjusting prices upward and downward relative to the (labor) values of their means of production is not sufficient to equalize rates of profit in all branches of production. This is because the means of producing commodities are commodities themselves and account must be taken of the
changes in their prices that result from such adjustments. Thus, when one lowers the price of a commodity with a low organic composition of capital one also lowers the (aggregate) price of the means of production of other commodities which utilize that commodity as means of production in their own production. Even if such a process of adjustment, or some modification of it, finally achieves uniformity in the rate of profit, it is no longer clear whether in the end the prices of commodities with high organic compositions of capital will be above their values and that the prices of commodities with low organic compositions of capital will be below their values. There may well be a commodity with a high organic composition of capital whose means of production are produced with such a low organic composition of capital that its price will need to be lowered in order to achieve uniformity of the rate of profit.

Recent developments in the Classical theory of value have made it possible to give substance to the 'socially average' rate of profit and organic composition of capital whose roles are so critical to the above chain of reasoning. Recall that the raison d'être of the price adjustments called for by the argument is the establishment of the same rate of profit in all branches of production. Hence if there is a commodity or composite commodity whose rate of profit is unalterable as a consequence of changes in prices it must be this rate of profit and the organic composition of capital of this commodity that play the critical role, for if uniformity in the rate of profit is to be achieved it must be this rate of profit which will rule the roost, so to speak.

The discovery of such a commodity (or composite commodity) is owed, of course, to Sralla (1960) and has been named by him the "Standard
Commodity*. It is simply a commodity (or composite commodity) whose means of production, in the aggregate, stand in the same proportions to one another as the commodities themselves stand to each other as outputs. The rate of profit in the production of such a Standard Commodity will clearly rule the roost for no alteration in prices can alter the rate of profit in its production. This is simply because the inputs and outputs of such a commodity are the same homogeneous stuff. Any change in the prices of inputs will necessarily be accompanied by a proportional change in the price of outputs. In a multiproduct economy it may be shown relatively easily that a unique composite Standard Commodity can always be found.

It thus appears that the first inadequacy of the RMM argument is easily overcome. As is shown in the counter-example that immediately follows, the second is not.

3. Counter-example

Consider a capitalist economy in which corn, grapes, and wine are produced. Assume that corn is produced by means of labor and itself. Assume that grapes grow in abundance on land, which we shall also assume exists in abundance, and are used exclusively as means of production in the production of wine. Grapes are thus 'produced' exclusively by labor. The (capital) advances of the grape producing capitalists are therefore the wages necessary to employ grape-picking laborers. Finally, assume that the wages of laborers consist entirely of corn and that the period of
production of each commodity is one year. The annual production of such an economy could be depicted in the following way:

\[
\begin{align*}
corn + labor & \rightarrow corn \\
labor & \rightarrow grapes \\
grapes + labor & \rightarrow wine
\end{align*}
\]

where the arrow means 'produces in one year'. To be more explicit we may write

\[
\begin{align*}
c + n_c & \rightarrow C \\
n_c & \rightarrow G \\
g + n_w & \rightarrow W
\end{align*}
\]

and make the corn wage per unit of labor time equal to \( d \) (mnemonic: 'daily bread'). The symbols are to be given the following meanings: \( c \) and \( g \) are the quantities of corn and grapes utilized, respectively, in the production of corn and wine; \( n_c \), \( n_g \), and \( n_w \) are the quantities of labor utilized in the three industries; \( C \), \( G \), and \( W \) are the gross outputs of corn, grapes, and wine.

Corn is the only basic commodity in the system and is therefore also the Standard Commodity. The rate of profit in producing corn, which is

\[
R = \frac{C - (c + n_c d)}{c + n_c d}
\]

is independent of prices since it is a ratio of homogeneous quantities (corn). If corn is chosen as the standard of exchangeable value and there is uniformity of the rate of profit in all three branches of production, then the following relationships are implied:

\[
\begin{align*}
(c + n_c d)(1 + R) &= C \\
n_c d(1 + R) &= Gp_g \\
(g p_g + n_w d)(1 + R) &= Wp_w
\end{align*}
\]
where $p_g$ and $p_w$ are the prices (in terms of corn) of grapes and wine.

Purely for the sake of analytical convenience, assume that the units of measurement have been chosen such that

$$C - c = 1$$
$$n_c = 1$$
$$G = 1$$
$$W = 1.$$  

The labor values of the three commodities are thus

$$L_c = n_c / (C - c) = 1$$
$$L_g = n_g$$
$$L_w = n_g + n_w.$$  

Since corn has been chosen as the standard of exchangeable value, its price is equal to its value.

The organic compositions of capital of the three industries are

$$\theta_c = c / n_c$$
$$\theta_g = 0 / n_g$$
$$\theta_w = n_g / n_w.$$  

Consider now the equation determining the price of wine. Because of the normalization being adopted here it may be written

$$p_w = (1 + R)(p_g + p_w)$$

$$= (1 + R)((1 + R)n_g d + n_w)$$

$$= (1 + R)^2 n_g d + (1 + R)n_w$$

$$= n_g + n_w - cn_g R^2 - (cn_g + cn_w + n_g)R$$

(2)

where between the third and fourth lines use is made of the equality between $d$ and $(1 - cR) / (1 + R)$, which is the solution of Equation 1 for $d$.

Inspection of Equation 2 reveals that when the rate of profit is zero
(and the wage equals 1) the price of wine is equal to its value \( n_g + n_w \).
The same, it might be noted, is true of grapes. Otherwise, as the rate of profit rises toward its maximum (= 1), the price of wine falls continuously. If the organic composition of capital in the production of wine were less than that in the production of corn (the socially average organic composition of capital), then this result would be entirely consistent with the RMM conjecture. But such need not be the case. The price of wine will fall below its value as the rate of profit rises irregardless of whether the organic composition of capital in its production is below or above the social average. A simple numerical example suffices to establish this point. Suppose that \( c = 1, C = 2, n_c = 1, n_g = 1, n_w = 6/7, \) and \( d = 1/6 \). The annual production that these numerical values imply is

1 t. corn + 1 labor \( \rightarrow \) 2 t. corn
1 labor \( \rightarrow \) 1 t. grapes
1 t. grapes + 6/7 labor \( \rightarrow \) 1 crate of wine.

The socially average organic composition of capital (i.e. the organic composition of capital in the production of corn) in this case is

\[ \Theta_c = c/n_c = 1/(1/6) = 6. \]

The organic composition of capital in the production of wine is

\[ \Theta_w = n_g/n_w d = 1/(6/7)(1/6) = 7. \]

Wine is therefore a commodity whose organic composition of capital exceeds the social average and whose price, according to the RMM conjecture, will exceed its value. But such is clearly not the case. The price of wine (= 36/49) is less than its value (= \( n_g + n_w = 16/7 \)). The RMM conjecture is thus proved false by counter-example.
The reason is simple. What we have here is an example of the possibility, mentioned earlier, of a commodity with a high organic composition of capital (wine) whose means of production (grapes) are produced by an industry with so low an organic composition of capital \( (\theta = 0) \) that its price must be adjusted downward in order to achieve uniformity of the rate of profit.

This counter-example may appear to the reader to be an eccentric one owing to the assumption that grapes are produced by labor alone, but this is not so. The result obtained above would remain even if it were assumed that corn is used in the production of grapes and/or wine. The reader is invited to work through the counter-example with the assumption that \( 1/1000 \) t. corn in addition to 1 man-year of labor is required in the production of 1 t. grapes. The result also holds under the Sraffian assumption that the wage is paid out of surplus (indeed, the demonstration is made more mathematically elegant by so doing--see the Appendix).

4. Conclusions

Interpretations, criticisms, and defenses of the labor theory of value abound, no doubt because of the crucial significance attributed to it as the centerpiece of the Marxist system as a whole. While it is admitted that it is unreasonable to view prices as equal to values, it is nevertheless insisted by many that values are the ultimate regulators of prices. One form of this defense is to argue that the naive labor theory of value, which equates prices and values, is akin to the principle of gravitation, in the sense that 'modifying principles' must be attached to it in order to account for disturbing influences such as friction. In this argument, differences in organic compositions of capital between industries
are likened to friction, and deviations of prices from values according to whether organic compositions of capital are above or below the social average, is cited as the appropriate 'modifying principle'.\textsuperscript{2} It is concluded that just as the principle of gravitation should not be rejected because of friction, so should not the labor theory of value be rejected because of differences in organic compositions of capital. This paper demonstrates that this analogy receives no support from the claim that deviations of prices from values depend in a systematic way on deviations of organic compositions of capital from the socially average organic composition of capital. The reason is simple, namely, the claim is false.
Appendix

The conclusions of the paper also hold in modified form in the more conventional Sraffian model in which wages are paid out of surplus. Strictly speaking, however, no organic compositions of capital, in the Marxist sense, exist in such a model. This is because wages are treated as a share of surplus rather than as a specifiable 'bundle' of commodities, as in the Marxist model of the text. Nevertheless, an analogous concept exists in Sraffa's 'proportions of labor to means of production', which is, in any industry, the ratio of direct labor used in production to the labor value of non-labor means of production. Some brief reflection should make it clear that a ranking of industries from those with the lowest proportions of labor to means of production to those with the highest will be identical to a ranking of industries from those with the highest organic compositions of capital to those with the lowest. The logic of the RMM conjecture can also be applied here: If prices were equal to values, those commodities produced with high proportions of labor to means of production would have the highest rates of profit and commodities produced with low proportions of labor to means of production would have the lowest rates of profit. Hence again it would appear that equality of rates of profit could be achieved by lowering the prices of commodities produced in industries with high proportions of labor to means of production and raising those of commodities produced in industries with low proportions of labor to means of production. And again there would appear to be a critical proportion of labor to means of production relative to which such proportions could be
judged to be high or low. Again, this conjecture is false. Prices of commodities with low proportions of labor to means of production will not be above their values and commodities with high proportions of labor to means of production will not be below their values. Indeed, prices may be above values or below values, or they may alternate and be above values over one range of the distribution of income and below values over another. At any rate, the pattern of relationships between prices and values is independent of, and not 'systematically related' to, the pattern of proportions of labor to means of production.

The model of the text may be adapted to demonstrate these conclusions as follows:

Again consider an economy producing corn, grapes, and wine in a manner identical to that supposed above. The price equations of such a system may be written

\[ cp_c (1 + r) + n_c w = p_c \]
\[ ng w = p_g \]
\[ gp_g (1 + r) + n_g w = p_w \]

where \( r \) = the rate of profit, and \( w \) = the wage rate. Assume, for convenience, that \( (n_c + n_g + n_w) = 1 \).

Some of the standard Sraffian results are:

(i) The Standard Commodity is composed of corn alone.

(ii) The Standard Ratio, \( R = (1 - c)/c \).

(iii) The Standard System is

\[ (1/n_c) c \text{corn} + 1 \text{ labor} \rightarrow (1/n_c) \text{ corn} \]

(iv) The Standard Commodity is \( (1/n_c)(1 - c) \) units of corn.

(v) When the Standard Commodity is numeraire,

\[ r = R(1 - w) = [(1 - c)/c](1 - w) \].
Consider now the price equation for wine.

\[ p_w = q_g (1 + r) + n_w w, \]

and assume, as in the text, that grapes are used only as means of production so that \( g = 1 \). Through substitution the price equation of wine becomes

\[
p_w = n_g w[1 + R(1 - w)] + n_w w \\
= -n_g R w^2 + (n_g R + n_g + n_w) w.
\]

A glance at the graph of this equation, shown below, will demonstrate the conclusion announced above. Even with the Standard Commodity as numéraire, as here, the price of wine may be above or below its value. Indeed, for low values of the wage it is below, while for high values of the wage it is above its value. This result is inconsistent with any argument maintaining that the prices of commodities will exceed or fall short of their values depending upon proportions of labor to means of production.

![Graph](image)

\[ L_w = n_g + n_w \]

\[ \frac{(1+R)n_g + n_w}{2n_g R} \]

Figure 1.
FOOTNOTES

1 See Ricardo (1821, Ch. I, Sec. IV), Mill (1871, Book III, Ch. IV, Sec. 5), and Marx (1894, Ch.IX).

2 This analogy is made in defense of Marx in Hunt (1978).
REFERENCES


