

A Note on the Formation of Prices of Production

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Preamble

Imagine the following very simple capitalist economy.¹ There are three sectors of production (which we shall label sector 1, sector 2 and sector 3). Sector 1 produces generic means of production, which is used by all three sectors. Sector 2 produces generic means of workers' consumption, consumed by the workers of all three sectors. Sector 3 produces generic means of capitalist consumption. We assume that all commodity product that is surplus to the replacement of the means of production consumed in production and to the requirements of workers' consumption is consumed unproductively by capitalists (in other words, we assume *simple reproduction*, i.e. that the material scale of production is constant over time).²

One production period (be this a day, a week, a month, a year) may be represented as in **table 1**.³

The *cost price* of a given quantity of commodity product is that part of its price equal to the sum of the price of the means of production consumed in, and the wages advanced for, its production.⁴ Given our assumption here that there is no fixed capital, the cost price of each sector is equal to the total capital advanced:⁵ that is to say, that advanced to buy means of

¹ The economic model set out here has been adapted from Shaikh 1977a and Shaikh 1977b.

² We also assume that the productivity of labour is unchanging, and that the price level is constant (that there is no change in the "value of money"), and we assume that all means of production are consumed in the production period in which they are put to use, i.e. that there is no fixed capital. In addition, all matters related to the circulation of commodities that might impinge on commodity values and prices are abstracted from.

³ In his treatment in *Capital* III, Marx sets out a numerical example in which there are a set of capitals of equal size (each equal to 100). Although this is more convenient for expositional purposes, Marx's example does not show a "full" economic system consisting of produced means of production, workers' means of consumption and capitalists' means of consumption. It can be shown algebraically that it is not possible to depict such a system *if* the capitals of which it is composed are, under initial conditions, of the same magnitude, *and* the whole commodity product is either productively and unproductively consumed, *and* there is an initial constant rate of surplus value, while maintaining a set of initial prices that is strictly positive.

⁴ The denomination of the money quantities as euros is a caprice of the author. They may naturally be imagined as dollars, pounds, yen, etc., to taste, as well as any given multiple of the figures shown.

⁵ In the case of there being fixed capital, the cost price of a given mass of commodity product is equal to the

Table 1: **Initial conditions**

sector	constant capital (c_0) (€)	variable capital (v_0) (€)	total capital (= cost price) ($c_0 + v_0$) (€)	organic composition ($\frac{c_0}{v_0}$)	surplus value (s_0) (€)	rate of surplus value ($\frac{s_0}{v_0}$)	price ($w_0 = c_0 + v_0 + s_0$) (€)	rate of profit ($\frac{s_0}{c_0 + v_0}$) (%)
1	80	20	100	4.00	20	1	120	20.00
2	30	20	50	1.50	20	1	70	40.00
3	10	30	40	0.33	30	1	70	75.00
aggregate	120	70	190	1.71	70	1	260	36.84

production (constant capital, c_0) plus that advanced as wages (variable capital, v_0).⁶ The rate of surplus value, the ratio of surplus value to variable capital, is assumed constant (and in the conditions depicted in table 1 as equal to 1 : 1).⁷ The price of the product of each sector is then simply the sum of the cost price and the surplus value: $w_0 = c_0 + v_0 + s_0$. The rate of profit in each sector (the rate per production period) is in turn equal to the ratio of the surplus value to the capital advanced (the latter, as we have noted, being equal, given the assumption of there being no fixed capital, to the cost price).

It is assumed here that the prices shown in **table 1** are prices that are *proportional to the labour-time required for the production of the commodities concerned*. These are prices that Marx calls the “monetary expression of value”;⁸ they are, in effect, the prices that *would* prevail under competitive commodity-producing conditions if there were no profit equalisation process in operation. Such prices I shall henceforward call “direct prices”.⁹

Under such a price regime it can be shown that under conditions of a uniform rate of surplus value differences in the ratio of constant capital to variable capital (this last being what is known as *the organic composition of capital*) will produce different rates of profit,¹⁰ and this

sum of the price of the means of production consumed in its production, the wages advanced for its production and that part of the depreciation of the fixed capital that corresponds to its production. This last component is obviously smaller in magnitude than the cost of the whole of the fixed capital concerned.

⁶ The subscript “0” is to indicate values corresponding to the initial conditions of the model, in which what I will call “direct prices” (defined below) prevail.

⁷ More precisely, what has been assumed here is a constant relation between the money advanced as variable capital (an index for the number of workers employed, and, given a uniform length of the working day, of the amount of labour-time expended in production) and the magnitude of the new value created in production (of 1 : 2). The magnitude of surplus value is then taken as the residual of this new value component after accounting for the wage, this last assumed equalised per worker.

⁸ “*Der Geldausdruck des Werts*” (Marx 2012, 248).

⁹ Nevertheless, it can be shown formally that, given the assumptions behind the economic model here set out, the algebraic procedure adopted in this note is valid for *any* set of commodity prices which produce unequal cross-sectoral rates of profit, that consisting of what I am calling “direct prices” included.

¹⁰ Let the rate of surplus value, $\frac{s}{v}$, be σ , and the organic composition of capital, $\frac{c}{v}$, be g . The rate of profit is the ratio of surplus value to total capital: $\frac{s}{c + v}$. If we divide the top and bottom of this last expression by v , we get $\frac{\frac{s}{v}}{\frac{c}{v} + 1}$, or $\frac{\sigma}{g + 1}$. This means that, given the rate of surplus value, the rate of profit will vary *inversely* with

is what we observe in **table 1**.

Marx, however, argues, *basing himself on observable empirical data*, that competition among capitals will produce a tendency towards profit-rate equalisation; specifically that competition among capitals will tend to bring about in each economic sector a rate of profit equal to, first, the rate of profit in all the other sectors, and, second, the *aggregate* rate of the whole economy. When this occurs, he argues, the commodities produced by the sectors in question will sell at what he calls *prices of production*; and it is to the formation of such prices that he directs himself in part 2 of *Capital* vol. III.

Marx's discussion unfolds in two distinct phases. In the first of the two substantial chapters of part 2 of *Capital* III (chapter 9) he deals with the formation of prices of production *algebraically*; in the second (chapter 10), he addresses the social mechanisms through which the tendency to impose prices of production on capitalist enterprises asserts itself. The difference in focus between the two chapters is important, and requires a little elaboration.

Marx's substantial point is that competition between capitals brings about a tendential diffusion and differential entry of capital towards sectors of production where the rate of profit is higher and away from those where it is lower. The migration of capital into more profitable fields of application will increase the scale of production, expanding supply relative to demand and lowering the per-unit prices of the commodities concerned, thereby, all else remaining equal, reducing both the profit margin and the rate of profit. The reverse will happen in those less profitable sectors that capital is, through the pressure of competition, drawn away from: here, the scale of production will contract, prices will rise, and along with them so will profitability. In this way, Marx argues, profit rates will exhibit a tendency towards equalisation. This is, in essence, what Marx deals with in chapter 10 of *Capital* III.

It is important to grasp that this *social* process is grounded in the expansion and contraction of the scale of production in different economic sectors in function of the migration of capital into and out of areas of production depending on prevailing levels of profitability.

Marx's discussion in the other substantial chapter of part 2 of *Capital* III, chapter 9, however, supposes *no* such changes in the scale of material production: this is what I mean when I say that his treatment is "algebraic". In chapter 9 he treats the formation of prices of production as a purely *mathematical* circumstance, and that is also what I shall be doing here; here, throughout, I shall assume that the material scale of production—the physical amount of commodity product produced and the amount of labour expended in production—remains constant.

There is an important corollary to this assumption—of a constant material scale of production—that is as well to state clearly here. What we might call Marx's "theory of value" is axiomatically premised on the notion that value itself—the ultimate determinant of commodity exchange ratios—arises and can only arise out of the action of labour in given conditions of *production*, and hence is *not* created in the sphere of commodity circulation. On the market, where commodities are bought and sold, all that can happen is that value whose magnitude is determined by the conditions of production is distributed between and among buyers and sellers: here, no *new* value can appear. If, therefore, one participant emerges from a commodity exchange with more value than they had when they went in this can only be because someone somewhere else in the system emerges with less.

the organic composition of capital.

In practical terms here this means the following. If we base ourselves on the assumption that value is created only by the conditions of production,¹¹ and then assert that both the material scale of production and the price level are constant, then it follows that the total sum of prices in the economic system under consideration must at all times remain the same. This last assumption will remain operative throughout this note.

The transformation procedure

At the beginning of chapter 9 of *Capital* III, Marx takes a set of capitals of unequal organic composition and equal rates of surplus value, and consequently unequal profit rates, and then recalculates the prices of the commodity products such that each capital's rate of profit is equal to both that of the others and the aggregate rate. The results of this operation, as applied to the economic sectors that appear in **table 1**, are set out in **table 2** below.

Table 2: Modified product prices

sector	constant capital (c_0) (€)	variable capital (v_0) (€)	total capital (= cost price) ($c_0 + v_0$) (€)	surplus value (s_0) (€)	direct price ($w_0 = c_0 + v_0 + s_0$) (€)	aggregate rate of profit (p'_1) (%)	equalised profit ($s_1 = p'_1(c_0 + v_0)$) (€)	transformed price ($w_1 = c_0 + v_0 + s_1$) (€)	difference ($w_1 - w_0$) (€)	transformation coefficient ($\frac{w_1}{w_0}$)
1	80	100	100	20	120	36.84	36.84	136.84	16.84	1.14
2	30	20	50	20	70	36.84	18.42	68.42	-1.58	0.98
3	10	30	40	30	70	36.84	14.74	54.74	-15.26	0.78
aggregate	120	70	190	70	260	36.84	70.00	260.00	0.00	1.00

Note that the differences between the direct prices and the transformed prices sum to zero, and that the sum of direct prices is equal to the sum of transformed prices. No new value has appeared here; in effect (and by design of the procedure) all that has happened is that value already produced (in the form of surplus value) has been redistributed between the sectors.

This is, perhaps unfortunately, as far as Marx goes in his argument in chapter 9, at least numerically. But he does seem aware that the procedure, thus far set out, is incomplete. For it cannot be the case, he seems to say, that the commodities that are sold as the commodity product sell at different prices as the same commodities that are bought as elements of cost price (directly in the case of means of production; indirectly in that of means of workers' consumption), at least not under the assumptions operative here (and implicit too in Marx's account) of constant labour productivity, scale of production and price level:

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 is involved, can also stand above or below

¹¹ Even if this statement here only has the status of *assumption*, the whole point of Marx's discussion in part 2 of *Capital* III is precisely to show that the formation of prices of production is not incompatible with the proposition that value can only be created through production by the action of labour. My argument here does not therefore rest on the demonstration of the truth of this but on the fact that the formation of prices of production does not violate it.

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 [...]. (Marx 1981, 264-5)

The final column of **table 2** (“transformation coefficient”) gives the ratios of the transformed prices to the direct prices of the product of each sector. We can use this coefficient to transform the elements that directly and indirectly constitute the cost prices—means of production, the output of sector 1; and means of workers’ consumption, output of sector 2—so that the prices of these elements of the cost prices are the same as those of each sector’s product.

In the case of sector 1, which produces means of production for the whole economy, its transformation coefficient, being greater than 1, means that the capitalists of all three sectors will incur a greater cost for the means of production they need to purchase in order to produce. In the case of sector 2, the producer of social means of workers’ consumption, that its transformation coefficient is less than 1 means that the money wage (assuming a constant real wage) will fall: this too will have an effect on the capitalists of all three sectors’ costs. (The change in the price of the product of sector 3 will have no effect on capitalists’ costs, since it produces only means of capitalists’ consumption, which do not enter in the sphere of circulation as components of cost price.)

What these adjustments to the prices of the elements of cost price represent therefore is a change in the costs incurred by the capitalists of each sector. They do *not* change the value created in each sector, and, given the assumptions operative here, *cannot* suppose any change in the total price of each sector’s commodity product (and hence as a consequence neither in the aggregate price of the total social product). Rather, what these changes in cost prices bring about is an effective *redistribution* of the total value produced in each sector between the components of profit on the one hand and cost price on the other.

The result of this modification of cost prices is set out in **table 3**.

Table 3: **Modified cost prices**

sector	transformed constant capital (c_1) (€)	transformed variable capital (v_1) (€)	transformed cost price ($c_1 + v_1$) (€)	transformed price (w_1) (€)	equalised profit (s_1) (€)	modified profit ($s_1^* = w_1 - (c_1 + v_1)$) (€)	diff- erence ($s_1^* - s_1$) (€)	rate of profit ($\frac{s_1^*}{c_1 + v_1}$) (%)
1	91.23	19.55	110.78	136.84	36.84	26.07	-10.78	23.53
2	24.21	19.55	53.76	68.42	18.42	14.66	-3.76	27.27
3	11.40	29.32	40.73	54.74	14.74	14.01	-0.73	26.67
aggregate	136.84	68.42	205.26	260.00	70.00	54.74	-15.26	26.67

Two things stand out here.

The first is the transfer of value in each sector from the profit component of the price of its commodity product to the cost price component. That these value flows are positive—i.e. that in all three sectors there is a reduction of the magnitude of profit and in each case an equal increase in the magnitude of cost price—is an artefact of the transformation coefficients (which are in turn a product of the relative weights of the organic compositions of the different sectors in total social production) and the particular weight of each element of cost price (means of production, means of workers’ subsistence) in each given sector. In turn, whether the *aggregate* flow is to cost price from profit, or to profit from cost price, is itself a

function of the flows in each sector and the relative weight of each sector in aggregate social production.¹² It would be evidently quite possible to construct numerical scenarios in which the flows depicted here were *negative*, either in one sector or another, or in the aggregate, i.e. in which the flow of value were from cost price to profit, both at the level of individual spheres, as well as in that of the aggregate.

It does seem, however, that, despite the incomplete nature of his numerical description of the formation of prices of production, this issue of intrasectoral value transfers arising from the modification of cost prices in line with the transformation of the commodity product prices is something that Marx was aware of. Noting that the adjustment of the prices of the social commodity product involves no more than an effective redistribution of surplus value among economic sectors, with the consequence that sum of the resulting cost prices and profits equals both the sum of prices of production and the sum of what I am calling here direct prices, he remarks that “[t]his [result] seems contradicted by the fact that the elements of productive capital [that is, of the cost prices] are generally bought on the market [at the new, transformed commodity product prices] [...], so that their prices include an already realized profit and accordingly include the production price of one branch of industry together with the profit contained in it, so that the profit in one branch of industry goes into the cost price of another.” Notwithstanding this, however, he notes, as we have here already observed, that “if the sum of the cost prices of all commodities in a country is put on one side and the sum of the profits or surplus-values on the other, we can see that the calculation [of the equality of cost price plus profit with both prices of production and direct prices] is correct.” (Marx, 1981, 259-60, italicisation added, translation modified.)

And indeed this is what we do see in **table 3**. The modified cost price in each sector includes profit redistributed within the sector, profit that had in addition been previously redistributed between sectors in the process of the formation of the new prices set out in **table 2**. At the same time, the sum of cost prices and modified profits are equal to the sum of the aggregate direct labour prices that we started with.

The second feature of **table 3** that attracts our attention is of course the fact that the intrasectoral value transfers just commented on have now produced a new disequalised set of sectoral profit rates. We shall therefore repeat the operation we carried out at the beginning of the transformation procedure and recalculate the commodity product prices that appear in **table 3**, so as again to return to a set of equalised rates of profit. **Table 4** sets out the result of this operation.

Now, however, we face the same problem we faced after carrying out the first transformation of commodity product prices; for now, of course, the elements of cost price are here bought at prices (the old set: w_1) *different* than the prices of the commodity output (the new set: w_2).

¹²Note, however, that the aggregate difference in profit brought about by the modification of the cost prices (of €15.26) is the same as the difference in the commodity product price of sector 3 brought about by the transformation of commodity product prices depicted in **table 2**. This has to be the case, since it is the aggregate surplus product, converted into money, i.e. the aggregate demand on the part of capitalists, that provides the demand for the realisation of the commodity product—in the form of capitalists’ means of consumption—of sector 3. That, in **table 2**, aggregate equalised profit (the sum of the components of s_1) stands at €70, while the transformed price (w_1) of the commodity product of sector 3, which can only be bought through unproductively consumed profit, is equal to €54.74, i.e. that there is an excess of aggregate demand for the product of sector 3, shows the *incomplete* nature of the process of transformation of prices when the prices of the elements of cost price have not been modified in line with the transformation of the prices of the aggregate commodity product. (This result can be seen repeated below in **tables 4** and **5**.)

Table 4: **Retransformed product prices**

sector	constant capital (c_1) (€)	variable capital (v_1) (€)	cost price ($c_1 + v_1$) (€)	price (w_1) (€)	ag- gregate rate of profit (p'_2) (%)	equalised profit ($s_2 =$ $p'_2(c_1 + v_1)$) (€)	trans- formed price ($w_2 = c_1$ $+ v_1 + s_2$) (€)	diff- erence ($w_2 - w_1$) (€)	transfor- mation coeff- icient ($\frac{w_2}{w_1}$)
1	91.23	19.55	110.78	136.84	26.67	29.54	140.32	3.48	1.03
2	34.21	19.55	53.76	68.42	26.67	14.34	68.10	-0.03	1.00
3	11.40	29.32	40.73	54.74	26.67	10.86	51.59	-3.15	0.94
aggregate	136.84	68.42	205.26	260.00	26.67	54.74	260.00	0.00	1.00

Let us then repeat the procedure we carried out above, and make the necessary modifications to bring the cost prices again in line with the product prices. The result of this is set out in **table 5**.

Table 5: **Retransformed cost prices**

sector	transformed constant capital (c_2) (€)	transformed variable capital (v_2) (€)	transformed cost price ($c_2 + v_2$) (€)	transformed price (w_2) (€)	equalised profit (s_2) (€)	modified profit ($s_2^* = w_2 -$ ($c_2 + v_2$)) (€)	diff- erence ($s_2^* - s_2$) (€)	rate of profit ($\frac{s_2^*}{c_2 + v_2}$) (%)
1	93.54	19.46	113.00	140.32	29.54	27.32	-2.22	24.17
2	35.08	19.46	54.54	68.10	14.34	13.56	-0.78	24.87
3	11.69	29.18	40.88	51.59	10.86	10.71	-0.15	26.20
aggregate	140.32	68.10	208.41	260.00	54.74	51.59	-3.15	24.75

Even though we seem here repeatedly to be solving one difficulty (the reappearance of disequalised rates of profit) only to create another (the prices of the elements of cost price being out of line with commodity product prices), something interesting is taking place with regard to the *evolution* of the system as we progress. As the sharp-eyed reader may already have noticed, the transformation coefficients in the last column of **table 4** are much closer to 1 than those of **table 2**. This is a sign that, as we transform the product prices and then the cost prices, the system is *converging* towards a single set of commodity prices that are truly “prices of production”: prices that, when applied to both cost prices and to product prices, produce equal profit rates and which then require no further modification.

In fact, after seven full iterations of the transformation procedure described above—modification of product prices to produce equalised rates of profit; modification of cost prices in line with product prices—we arrive at a set of prices and rates of profit stable to two decimal places, as set out in **table 6** (the subscript “*p*” indicating “final” prices of production).

Conclusions

Over the course of the algebraic operations effected above, the economic system examined in this note exhibits a convergence towards a set of commodity prices that produce equalised profit rates when applied to both the commodity product and cost prices. The reasons behind

Table 6: **Final prices of production**

sector	constant capital (c_p) (€)	variable capital (v_p) (€)	cost price ($c_p + v_p$) (€)	rate of profit (p'_p) (%)	profit ($s_p =$ $p'(c_p + v_p)$) (€)	price of production ($c_p + v_p + s_p$) (€)
1	94.08	19.43	115.51	24.32	27.61	141.12
2	35.28	19.43	54.71	24.32	13.31	68.02
3	11.76	29.15	40.91	24.32	9.95	50.86
aggregate	141.12	68.02	209.14	24.32	50.06	260.00

this convergence are beyond the scope of this note but rest on the underlying structure of the economic system under consideration; it can in fact be shown formally that, for any economic system which produces means of production and means of consumption for workers and capitalists whose aggregate commodity product, including its surplus product, is productively and unproductively consumed in its entirety in the manner depicted here, any set of per-unit commodity prices that produce unequal sectoral rates of profit can be transformed following the procedures set out here into a set of prices that fulfil the requirements of prices that Marx calls prices of production.

There are hence good grounds therefore for arguing that the transformation procedure—the algebraic formation of a set of commodity prices of production out of one of prices proportional to labour-time (“direct prices”)—that Marx sets out in chapter 9 of *Capital* vol. III, in which he transforms a set of commodity product prices, warns us against forgetting to take account of the fact that the elements of cost price are also sold at prices of production, and then moves on to other matters, is incorrect only in the sense that it is *incomplete*.

It is entirely beyond doubt that Marx really did believe that prices of production in the “abstract” existed. Whether he had thought through the implications of there being a “transformation procedure” of the kind that I have set out here at the time he wrote the manuscript material for *Capital* vol. III, however, can only really be a matter of more or less educated speculation.

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¹³ Available here: https://drive.google.com/file/d/119Y_KkNGIj5zaN8SOCX7Tq6QmD4aw_Ek/view?usp=drive_link.