

TRANSFORMING VALUE INTO PRICES OF PRODUCTION WHICH YIELD AVERAGE RATES OF PROFIT NOT ON THE OLD CAPITAL, BUT ON THE NEWLY PRICED CAPITAL.

Preface.

In my first published (September) solution to the transformation problem, there is an arithmetical error. Seeking to establish continuity between Marx's tables I did not adjust the aliquot shares of the 312 capital used up in a manner consistent with the appreciation or depreciation of capital. In this revised paper these inconsistencies are reversed. The methodology remains sound. It is clear that in distributing surplus value between capitals, not only is an average rate of profit established, but the very capitals themselves are either appreciated or depreciated by the same process. In Chapter 9 of Volume 3 Marx did not appreciate or depreciate the 5 capitals in response to the distribution of surplus value. They were kept at 100 each. That required an additional step which is absent in Section 2 of the third volume of *Das Kapital*. It is this absence that explains why it has taken such a long time for a solution to be found, as it is impossible to convert value into price without doing so. We may thus put forward a more complex definition of prices of production, one which is more concrete than that proposed by Marx. *The "price of production" is not the price which yields an average rate of profit on the old capital, but the average rate of profit on the newly appreciated or depreciated capital.*

Section 2 remains unaltered.

SECTION 1. Introduction.

In the last paragraph of Section 1, Volume 3, as Marx is about to commence investigating capitalism in its complex and no longer abstract form, as many capitals, all different, he reminds us of his conception of value. *"The value of any commodity – and thus also of the commodities of which capital consists of – is determined not by the necessary labour time that it itself contains, but by the socially necessary labour-time required for its **reproduction**".* (page. 238 Penguin Edition our emphasis) He then goes on to say that if the conditions of production changes so that reproduction requires only half the labour time, capital worth £200 previously would now be worth only £100 and vice versa if the costs of reproduction doubled rather than halved due to adverse conditions.

If we had to look for an equivalence between many of Marx's critics and his defenders it is this; they all assume the embodied theory of value rather than the reproduced theory of labour. One of the contemporary books that defends Marx and which does not suffer from this fundamental flaw is *Marx's Theory of Price and its Modern Rivals* written by Howard Nicholas and published by Palgrave Macmillan (2011). His investigation is consistent and his criticisms of the treatment of Marx is accurate.

In this part of the paper we will be using Marx's method to establish once more, that the criticism of Marx's Transformation Problem (Chapter 9) is well, not a problem after all. It will now be referred to as the transformation solution. But we will be going further. The reproduction concept of value used by Marx is associated with capital in general. Here capital is considered as a single average capital. However in the real world addressed by Volume 3, we are dealing with many capitals that are different. This necessarily results in a modified form of value which Marx called market values (Chapter 10), values that are no longer simple averages but weighted averages. In establishing weighted averages as the essence of value and elaborating on it in Part 2, we overcome much of the confusion between embodied and reproduced labour that has derailed so many supporters of the labour theory of value.

Part 1. The Transformation Problem. Chapter 9, Volume 3.

The problem confronting Marx was this. When he examined capital in general, that is capital in its uncluttered form, he assumed all capitals were average, average size and average composition **enabling equal exchange**. Under these conditions an average rate of profit would prevail throughout the economy because the average capital was of average composition and workers suffered an average rate of exploitation. This uncluttered world was necessary to examine and describe the capitalist social relation in its pure form without being continuously distracted by the lack of average that constitutes the real world.

But capitals (firms and industries) do not exist as average in the real world. They are different. If commodities exchanged at their value within a single industry, different and uneven capitals would produce different prices, and between different industries different capitals would yield different rates of profit. This is patently absurd. We know in the real world, that within an industry, there is only one price for a product, its market price, and we know that between industries their tends not to be different profit rates but a single (oscillating) average rate of profit.

What Marx had to explain was how values are transformed into prices such that a single price prevails in one industry and a single rate of profit prevails between industries. He did so by showing that in the real world exchange is not equal but unequal though in aggregate these inequalities balance out. Accordingly prices can and do deviate from values, being either higher or lower. In other words that an elastic relationship exists between prices and values, prices could stretch above values or be compressed below values but they were always anchored on the one side to values.

It is of course one of the great mysteries of economics, why the transition from equal exchange to unequal exchange should be used to dismiss the labour theory of value. Why if exchange was equal, the labour theory of value was valid, but if exchange was unequal it became invalid. This is not a semantic argument, for these deviations give rise to illusions which sustains this argument. Marx was only too aware of this. The very elasticity between prices and values appears to liberate prices from being anchored in value, to give them an independent existence and thereby nourish vulgar economics.

As price prances around the dance floor, the vulgar economist becomes intoxicated by the developing dance. Transfixed by the dancer, the low cut dress, the tight trousers, the manicured hair, the clean shaven face, the colour of it all, they are mesmerised. Dazzled and bewitched, he or she does not ask why the dance is taking place where it is, why the dance floor is the size it is and how the dancer appeared in the first place. The dance is all that matters, the undulating and unstoppable dance of master or mistress price. As for the dance floor that confines price, the floor of value on which it dances, that is of no concern to those who worship the appearance of things and are satisfied by the gratification it affords. This then is the world of commodity fetishism, which sees commodities not as emerging out of the social division of labour, but merely takes the results of this division - a multitude of different products whose individual usefulness dominates perception.

But unlike the vulgar economist, whose craft is the investigation of the superficial, we are vitally concerned with the relationship between the dancer and the dance floor, the connected movement between prices and values and the laws that govern this movement and the extent of this movement. The problem confronting Marx was that capitals of equal size but of different composition yield in real life an average rate of profit when strictly speaking, a dogmatic and crude interpretation of the law of value would have them yielding differing individual rates of profit.

The differing compositions of capital are at their most pronounced between industries. By this we infer that the technical requirements between industries forces some industries to employ relatively more machinery/equipment and in other industries relatively more labour. For example a clothing factory may see hundreds of workers as in Bangladesh, sweating behind hundreds of sewing machines in unsafe buildings. On the other hand an automated oil refinery may see only a few dozen workers supervising a facility that extends over many acres and which contains a huge processing plant.

In the clothing firm the capital required may be under a hundred million, much of which is spent on wages. In the oil refinery the capital required may be over a billion much of which is spent on means of production and raw materials. In other words, at the oil refinery, each worker sets in motion much more means of production than does the worker in the clothing firm sweating behind a sewing machine.

Capitals with different technical compositions also have different value compositions when viewed socially. The relationship between means of production and living labour really expresses the ratio of past labour to present labour. Past labour has a value fixed in the means of production and present day labour, labour in action, produces new products and new value. To set production in motion the capitalists have to invest in both means of production and hire workers. Marx described these two aspects of capital thus:

$C = c + v$ where C is total capital and c is means of production and v is living labour.

Marx called little c constant capital and little v variable capital. There was a good reason for this. The total labour time of society crystallised in the stock of commodities, comprises on the one hand the labour from the past fixed in the means of production (machinery, buildings, materials etc.) and on the other, the labour time newly added by current production. It follows that as means of production or little c, is stored labour, its value cannot increase, it is constant. Only the labour newly added represented by variable capital, present day workers can increase the total labour produced.

So v is variable capital because it is the capital that employs today's workers, that produces new and additional labour which adds to the labour of society. This new labour comprises paid labour and unpaid labour, surplus value which forms the profits of the capitalist class. So employing many workers, such as in the clothing factory, should produce lots of profits. Accordingly the rate of profit should be higher in the clothing factory than the rate of profit in the oil refinery because more workers are employed here set against little means of production. On the other hand, in the oil refinery there are few workers to produce profits but a huge means of production over which to measure these profits.

And yet in real life they would each achieve similar rates of profit as otherwise the capitalists would close their oil refinery and move their capital to Bangladesh where they would invest in producing shirts using lots of workers and little means of production. Chapter 9, Volume 3 of *Das Kapital* is devoted to resolving this contradiction. Here Marx explains how the transformation solution works, how market values are converted into prices of production, a set of prices that allows for the emergence of a more or less uniform rate of profit. Of course this is not a mathematical calculation, it was the result of decades of movement by capital between industries searching out the best rate of profit, the emergence of new industries that disrupted this process, a ceaseless and ongoing process whereby capital sloshes around flattening the rate of profit by its movement.

It is difficult if not impossible to capture this restless movement of capital mathematically for the simple reason that the movement of capital not only levels the rate of profit, it also changes the conditions of production by its movement. Industries from which it flows contract and industries to

which it flows expand. As a result there is a combined alteration in the compositions of capital and therefore in the balance of living labour to past labour (c to v)

Knowing this Marx put together a simple arithmetical illustration to demonstrate how far prices needed to deviate from values in order to establish a uniform rate of profit. It was not a proof and should not be read as such. We display his final table in Chapter 9 below to illustrate his solution.

Table 1.						
Capitals	Surplus Value	Value of commodities	Cost price of commodities	Price of commodities	Rate of profit	Divergence price vs value
i) 80c+20v	20	90	70	92	22%	+2
ii) 70c + 30v	30	111	81	103	22%	-8
iii) 60c + 40v	40	131	91	113	22%	-18
iv) 85c + 15v	15	70	55	77	22%	+7
v) 95c + 5v	5	20	15	37	22%	+17
= 500	110	422	312	422	22%	0

(page 256, Volume 3 Penguin Edition)

Marx deploys five capitals each amounting to 100 totalling 500. They have different compositions or c to v ratios. Some employ much more means of production (Capital 5 or V) while others employ relatively more workers (Capital 3 or iii) Regardless of their number, each worker suffers a rate of exploitation of 100%. Under these conditions different rates of profit would result, ranging from 40% (third Capital) (s/c+v) down to 5% (fifth Capital). These figures are detailed by Marx in other tables in Chapter 9 so need not be repeated. Clearly different rates of profit are a nonsense and what Marx does in this arithmetical illustration is to show how much surplus value needs to be redistributed between these 5 Capitals to allow each to enjoy the average rate of profit of 22%. This is revealed in the final column – “*Divergence price vs value*”.

This illustration is consistent. Total prices do not exceed total values, total profits do not exceed total surplus value. All that is altered, is that exchange previously taken as equal, is now unequal to the degree that it yields an average rate of profit. There are two losers from this unequal exchange, the second and third Capitals that lose £8 and £18 respectively and there are three that gain, the first fourth and fifth Capitals that benefit by £2, £7 and £17. The gains exactly cancel out the losses leaving the total profit unchanged.

All that has happened is that unequal exchange has redistributed value between these five capitals. The mystery of how this can happen is money. Money is the universal equivalent. When exchange is equal the amount of money received represents the value of the commodities being sold. When exchange is unequal, either more or less money is received in exchange. Like Marx in Chapter 9, we assume the value of money does not change and there is a sufficient quantity of money to circulate the output of these 5 capitals.

Now before we set off to examine the criticisms of this solution we need to point to an often overlooked fact. Marx refers to his modified prices in the table above as *commodity price* and not *price of production*, the actual prevailing prices in the market. This is no aberration, in the line immediately above the table cited on page 256, he refers once again to commodity price and not price of production. Marx was knowledgeable that this simple table, aimed at illuminating just how much surplus value needed to be redistributed, could not hope to capture the complexity of the actual movement of capital over time to achieve this result. All he was doing was modifying prices. As he says a few pages later; “*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.” (pg265)

Over a century ago, in 1907, an incongruity was found in his method by Ladislaus von Bortkiewicz. He pointed out that the calculation of profit was based on values and not actual prices. When capitalists add the rate of profit to their cost price, the prices that compose the cost price are themselves prior prices of production. In other words the input prices (cost price) and the output price (cost price plus rate of profit) must be based on prices which differ from their underlying values. Yet here was Marx taking actual values to mean cost price. What is forgotten is that this was entirely legitimate, because the capital from which the consumed value was taken as cost price, were themselves still measured in value terms and not price terms.

And so an arithmetical illustration was turned against itself. It was used to prove that it was impossible to transform values into prices. This is partially true, but only if one uses the embodied theory of value rather than Marx’s reproduced theory of value. Below we show the different effects this has on the transformation problem. In the reproduced theory of value the redistribution of surplus value effects the whole output and therefore the entire capital. There is no distinction between its unconsumed part and its consumed part, its non-circulating part and its circulating part. In the embodied theory of value the unconsumed part of the capital retains its value while only the circulating (used up) part of the capital is appreciated or depreciated.

In the table below the divergence of prices used by Marx in the final column of the table above is used to appreciate or depreciate the 5 components that make up the entire capital (consistent with the reproduced theory of value). The redistribution of surplus value occurs over the new value added as well as the value used up and which amounts to 422 (*Table 1 Value of Commodities*). Of this 422, 110 will be consumed unproductively (removed) as profit by the capitalist class, leaving 312 to be thrown back into production (invested) and added back to the 188 of unconsumed capital making up 500 capital in total once more.

In order to remain true to Marx labour theory of value based on reproduction we note that at the end of the production cycle, the moment when part of the social product will have been sold, the total value in existence is 500 capital plus 110 profit or 422 new value + 188 unconsumed capital yielding a total value of 610. It is this 610 that is to be transformed. (The reason for using 610 as the denominator is explained at the end of the section.)

We begin by looking at the first of the five Capitals in Table 2 below. We note it benefits by £2 and its share of the total value increases by 0.3% or 2 over 610. In the case of Capital 3 its loss is -18 or -3.0% (-18 over 610). These aliquot percentage appreciations or depreciations is set out in Table 2 and applied to the each of the capitals as a share of the total. The result is shown in column (b) *New Capital*. The changed shares of the total capital are set out in column (c).

Here we are treating each capital as an aliquot part of the whole and their comparative appreciations or depreciations are based on this. The appreciation or depreciation is the result of the newly introduced unequal exchange which affects the entire 610 value and results from the degree and direction of this inequality. We note that in above average composition capitals there is an appreciation and in below average composition capitals there is a depreciation. This accords with the results set out by Marx in his calculations in Chapter 11.

Table 2

Old Capital	(b) New capital (Repriced)	(c) %difference (610)	:	(d) c+v	(e) cost price	(f) %difference (312)
100	102	+0.33%	:	70	72	+2.9%
100	93	-1.31%	:	81	73	-9.9%
100	85	-2.95%	:	91	73	-19.8%
100	106	+1.15%	:	55	62	+19.2%
100	114	+2.79%	:	15	32	+213.3%
500	500	0%	:	312	312	+205.7%

We note further that the capitals in monetary terms appreciate or depreciate by less than we expected. In the case of capital 5 its capital increases to 114 and not 117. That is due to 17 over 610 yielding an increase of only 14. Similarly with capital 3 it depreciates by less than expected, in this case by 15 instead of the expected 18.

The right hand side of the table shows something quite different. We no longer deal with reproduction applying to all commodities. In columns (d), (e) and (f) we show what happens when labour is treated as embodied labour. Only the active or circulating part of the capital is appreciated or depreciated. The redistribution of value is confined merely to the used up c+v or 312. The first thing we note is that the percentage deviations in price and values between columns (c) and (e) are much greater. That is because the same redistribution of surplus value is applied to 312 (column d) the consumed capital, whereas it is applied to the whole capital in (b) of 500. But this is by and by, of little interest, what is of primary interest is that the differences no longer balance out. In column (c) they balance when we spread them over the total capital but in (f) they do not and we are left with a +205.7% difference.

The reason is not hard to find. It is the disproportionate consumption of capital. What is dissimilar is that 91% of Capital 3 is used up (column d) whereas in Capital 5 only 15%. This means that when we compare the additions or subtractions to these two capitals the denominator is different. So the 32 over 15 (cost price) in Capital 5 will have a much greater impact than 73 over 91 (cost price) in Capital 3. As a result, the uneven consumption of capital yields uneven results and so instead of balancing, of achieving 0%, we end up with +205.7%. This huge plus means that within a short time, instead of five capitals we would be left with less than five and reproduction would break down

What is really happening here is that we are leaving some of the capital at its old value and we are repricing some. We have achieved a mishmash of embodied value (unchanged) and modified prices (changed) and given their disproportions, we end up with invalid conclusions. In sum, total values no longer equal total prices and total profits no longer equal total prices. In other words it is impossible to maintain the two invariances (surplus value = profits and prices = values) unless we reprice the entire social product.

Even Von Bortkiewicz falls foul of this variance. His method is not based on reproduced labour times. As proof we cite the fact that in order to get his maths to work, he assumes cost price to equal the total capital. He assumes that each year all the capital (c+v) is consumed in production instead of only part of it. In contradistinction Marx consumes only 312 of the 500 in capital or less than two thirds. Von Bortkiewicz clearly employs an embodied labour time model but avoids most of its pitfalls by consuming the total capital in his modelling.

We therefore find the unintended hero of the left, the mathematician who allegedly identified a fatal flaw in the transformation problem, only to correct it, did not actually understand Marx's labour theory of value. And if you operate with the wrong assumptions, even the best maths cannot correct

for this. If one takes the wrong turn, all maths will tell you is exactly how many kilometres, metres, micrometres you went wrong or how far distant you are from your goal. It gives exactitude to the mistake but cannot prevent the mistake happening in the first place. That is the purpose of theory and using the correct assumptions.

Marx was quite clear. He rejected Von Bortkiewicz’s method out of hand. He forbade a method which consumed the total capital each time. As he says on the second page of Chapter 9 “Yet in order not to arrive at totally incorrect conclusions, we must not take all the cost price as 100” (page 255). Marx goes on to point out that in real life, higher composition capitals consume less of their capital (Capital 5) and lower composition capitals consume more of their capital (Capital 3). The importance of this will become clear as we develop Marx’s understanding of this differential consumption of capital as a way of explaining how the real world of capitalism operates.

We continue our defence of Marx’s transformation solution by reproducing part of the table above to show how the redistribution of surplus value resulted in repricing the 5 Capitals and how this is indispensable in providing the basis for the second part of the solution. We recall that the redistribution of surplus value has not only yielded an average rate of profit, but it has altered the price of the capital on which this average rate of profit is to be calculated. More later.

Table 3.

New capital	Appreciation Depreciation	% of total	CAPITAL
102	+2	20.4%	(i) or 1
93	-7	18.6%	(ii) or 2
85	-15	17.0%	(iii) or 3
106	+6	21.2%	(iv) or 4
114	+14	22.8%	(v) or 5
500	0	100%	

The first column shows the new price of each Capital, and the second by how much each has been appreciated (+) or depreciated (-). No longer is the aliquot size or share of each capital equal to 20% of the total. In the third column we show that these new aliquot shares are no longer a uniform 20%. Unequal exchange has expanded the price of capital in one part only to reduce it in another.

From now on we will no longer look at individual capitals but at capitals as a share of the total capital. This is consistent with maintaining the integrity of reproduction. We notice the maximum appreciation and or depreciation is under 3%. Both limits fall well within the rate of profit of 22% so that each firms has sufficient capital to purchase means of production from each other and labour power from their workers. Reproduction will not break down due to one capital running out of capital and therefore having to shrink its production.

Some firms will find they pay more and others less for each other’s inputs. Capital’s 1 and 3 will pay more and capitals 1, 4 and 5 will pay less. The result is that their capital will swell or contract by the degree set out above. Our attention will be focused not so much on the change in the terms of exchange but on its effect, the changing shares of the total capital commanded by each capitals.

We can now use these same appreciations and depreciations and apply them to the cost prices found in Marx’s tables. We note that the total capital remains at 500 but due to appreciation or depreciation each capital is no longer priced at 100. The important issue here is that the cost price of each capital must replenish each capital in such a way that it maintains its new price. There is a direct link between the price of capital and its cost price.

In order to proceed, a number of points have to be reviewed. The social product of 422 is composed of capital of 312 and profit of 110. This profit is withdrawn from circulation by the capitalists and unproductively consumed. (It is lost to society.) This leaves only 312 which will re-enter production to be added back to the 188 of capital unconsumed which remains in the pot of each of the 5 Capitals. This 312 replenishes the original capital making up 500 (simple reproduction) and so it alone is responsible for repricing the 5 Capitals.

Not only does the 312 replenish the total of 500 but the change in the distribution between each of the five Capitals replenishes each capital differentially. When the five Capitals sell their commodities they receive money. Because of uneven exchange some will receive more money and some will receive less. Those that receive more money will add this to their existing capital which will be swelled and those that receive less money than before will see their capital shrink.

The key is that the cost price must add or subtract sufficient money so as to maintain each capital at their appreciated or depreciated levels as set out in Table 3. This will occur over repeated cycles until the conditions of production change. Until then we may call these prices, equilibrium prices. The replenishing cost price is shown below in Table 4.

Table 4.

Capital	c+v used up	Plus/minus Appreciation Depreciation (Table 2/3)	Equals Replenishing cost price
1	70 (22.4%)	+2	72 (23.1%)
2	81 (26.0%)	-7	74 (23.7%)
3	91 (29.2%)	-15	76 (24.4%)
4	55 (17.6%)	+6	61 (19.6%)
5	15 ((4.8%)	+14	29 (9.3%)
Totals	312	0	312

We recall the original c+v was a 'cost price' based on value. It is now transformed into the actual cost price by increasing or decreasing it in proportion to the appreciation or depreciation of the capital that produced it. In short by the monetary difference between the old and new capital. There is thus a change in the aliquot shares of the 312 each capital enjoys. In the case of Capital 5 it has jumped from 4.8% to 9.3% and in the case of Capital 3 it has shrunk from 29.2% to 24.4%. It goes without saying that this is consistent with the fact that Capital 5 is of above average composition and Capital 3 is below composition. So instead of Capital 1 receiving back 70 it receives back 72 whereas Capital 2 receives back 74 instead of 81.

Another way of arriving at and confirming the cost price is set out in Table 5 below.

Table 5.

Capital	Newly Priced Capital	Less Unconsumed Capital	Equals Replenished Cost Price
1	102	30	72
2	93	19	74
3	85	9	76
4	106	45	61
5	114	85	29
Totals	500	188	312

Column 2 is the Newly Priced Capital drawn from Table 3. Column 3 is the unconsumed capital still at its value (taken from Chapter 9) and as it would appear on the balance sheet of each company until its product is sold. Column 3 is the Cost Price in monetary terms needed to appreciate or depreciate the total capital. It is arrived at by simply deducting the old unconsumed capital (column 3) from the newly priced total capital (column 2). The balance is the amount of new money the cost price must yield to raise the total capital back to its newly appreciated or depreciated level.

The advantage of this perspective is that it is easier to demonstrate why cost prices have to shift in one direction or the other and by how much. In the case of Capital 5, the amount of unconsumed capital amounts to 85 or 85% of the original capital. It therefore requires proportionately more money to compensate for the amount of unconsumed capital and so its cost price must rise the most. Its share of the 312 almost doubles from 4.8% to 9.3% (Table 4). The opposite is the case with Capital 3 whose unconsumed capital amounts to only 9%.

Having transformed input prices from value into price we can now take the final step and solve for the prices of production. This is done below in Table 6.

Table 6.

Cost Price	Adjusted profit	Price of Production.	Marx's "Price Of commodity" (Volume 3 Chapter 9).
72	22.4 (102 x 22%)	94.4	92
74	20.5 (93 x 22%)	94.5	103
76	18.7 (85 x 22%)	94.7	113
61	23.3 (106 x 22%)	84.3	77
29	25.1 (114 x 22%)	54.1	37
312	110	422	422

Our attention is drawn to the second column, the 'Adjusted Profit'. Previously each capitalist shared equally in the 110 of profit enjoying 22 profit per capital or 22%. Now we note that they share unequally. Capitals 1, 4 and 5 due to their appreciated capital walk away with more profit and Capitals 3 and 4 walk away with less profit. This adjusted profit when added to the new cost price yields the actual price of production found in column 3.

This is why we have had to alter the definition of the 'price of production' as being that price which yields an average rate of profit, to that price which yields an average rate of profit on the newly priced capital. We note the large discrepancy that exists between the newly determined prices of production and the original commodity price found in Chapter 9 of Volume 3 and detailed in Table 1 above. This is particularly true for capitals that rise most above or fall furthest below the average composition of capital. We refer of course to capitals 3 and 5.

The reason for this is that cost price is now priced, and that the rate of profit is itself now calculated on capitals that have themselves been repriced.

In Marx's original tables (our Table 1) the 'Price of Commodities' was made up of c+v plus 22 profit. We set out those figures once again in Table 7 below to refresh ourselves because they relate to figures before we have appreciated or depreciated the total product. The reason we have reversed the order to arrive at the original c+v will become clear as will the reason we have gone back to our starting point.

Table 7.

Capital	Price of Commodity	less profit	equals c+v	plus unconsumed capital	Equals Total Capital.
1	92	22	70	30	=100
2	103	22	81	19	=100
3	113	22	91	9	=100
4	77	22	55	45	=100
5	37	22	15	85	=100

At the end of the cycle of production and sale described above each of the 5 capitalists would have been in possession of a sum of money corresponding to the amount set out in column 1. From this sum they would have each withdrawn 22 profit. In the case of Capital 5 the amount is 37 less 22 which equals 15. 15 added back to the unconsumed part of its capital of 85 would restore their capital back to 100. If we turn to Capital 3 the same is true. 113 less 22 profit equals 91 new money which added back to its unconsumed capital of 9 yields 100 capital once more. In other words though there has been a prior redistribution of value it has left everything unaltered once the profit has been removed and we are back to our original state once the capitalists have withdrawn their profit from the new money they have received.

Contrast this to what we have set out and which constitutes a development of the transformation solution. If we take Capital 5 again, its new price of production is 54 (rounded off). After deducting the 25 of profit (no longer 22), 29 is left over which when added back to the 85 now amounts to 114. In other words the capital is not returned to 100 but back to 114 its new price. The same applies to all the other capitals. We have moved from all capitals being priced at 100 and earning 22 profit to newly priced capitals and newly priced profits. The new prices of production continuously reproduce the prices that have resulted from the prior redistribution of surplus value. We remain in the new state where prices no longer correspond to their underlying values.

We may conclude on a final point. Taking Capital 5 once again as our example, we recall that in Table 1 it required an additional 17 in surplus value to allow it to enjoy the average rate of profit of 22%. In our model, that 17 is split up into 14 new capital and 3 additional profit. The same applies to Capital 3. It lost 18 which is now represented as a fall of 15 in capital and 3 in profit (rounded off). The result is that Capital 5 enjoys a profit of 25 (no longer 22) and Capital 3 enjoys a profit of approximately 19 (no longer 22). This explains why the appreciation or depreciation of capital had to be calculated over the full 610 and not 500. The difference produced the residual value that had to undergo a final redistribution so that a 22% rate of profit was maintained. This is also the final proof that this transformation solution is in order

It is important to note that despite these price changes nothing has changed materially. Only Money Capital M^+ or M^- has changed. Capitals 1, 4, and 5 have more money capital whereas Capitals 2 and 3 have less. Some will benefit and some will lose from this now unequal exchange. But each capital will continue to produce the same quantity of commodities, using the same quantity of means of production and labour power and will continue to exploit their workers to the same degree.

The ability to solve prices of production has little import for a socialist economy. Its utility lies in the field of ideology, namely reinforcing our ability to defend and reinforce the labour theory of value. The two papers I have proposed provides a method of moving from values to prices and is in accord with assumptions and methods laid down by Marx. It demonstrates that the Transformation Problem can be dealt with on its own terms and does not need to be avoided. More importantly it certainly

does not need the ludicrous alternative solutions proposed since 1907, which have made matters only worse and hobbled our understanding of pricing under Capitalism. (Note 1.) The annihilation of these revisionist solutions will be found in Bill Jeffries paper entitled: *Piero Sraffa, and the Production of Commodities by Means of Magic* (to be published shortly).

The transformation of value into prices of course involves two distinct transformations, the first found in Chapter 10 (to be dealt with in Section 2) which yields market prices and the second found in Chapter 9 which yields an average rate of profit. The one that has the most consequence for socialism is the first transformation; that of market value based on weighted averages. Weighted average labour times represent the actual cost of producing any item and will form the bedrock of our pricing system under socialism, not as the law of value, but its conscious replacement - direct measurement. In turn it will be this objective pricing system that will displace the profit motive as the mechanism which unites society in common effort and directs its productive capacity in the most efficient way. It is ironical therefore, that all the venom, heat and effort has been directed at prices of production, when it is the solving of market prices that has the most consequences for the future.

The value and price of Labour Power.

But what about the workers. If each capital spends the same percentage of their capital on variable capital as we have assumed above, in order to maintain proportionality in our model, it is clear that Capitals 1, 4, and 5 will have more variable capital to spend on their workers. As the number of workers remains the same in each capital, wages will go up. It will go up a little in Capital 1, more in 4 and the most in 5. Conversely, wages will fall in Capitals 2 and 3 because their variable capital, their capital available for wages as a proportion of their total capital is now diminished. However, once again what is gained equals what is lost, resulting in the total wages paid by all 5 capitals remaining unaltered. These wages match the prices of the articles produced for workers so all that is produced is consumed.

However something has changed. The living standards of workers are now different. Some can buy more articles of consumption, others can buy less. The price of labour power has replaced the value of labour power, yielding unequal wages. Some workers are enriched and others impoverished, most of all the workers who work for Capital 3. It may transpire that there the price of labour has fallen below the value of labour power to the extent that some workers are starving and unable to work. Under these conditions, reproduction would break down.

However the opposite can also be argued. Capitals 2 and 3 with their low composition of capital are typical of capitals found in department 2, the department producing articles of consumption for workers. If this is the case, then all the prices of the articles of consumption for workers will fall. In this case it could transpire that total wages exceed the sum of the prices of the basket of goods produced in Capitals 2 and 3. This means workers will still have cash in their pockets once all these articles have been bought. This cash will reduce the amount of capital below 500 as it will be removed from circulation. So here the price of labour power has so far exceeded the price of the basket of articles produced for workers' consumption that reproduction breaks down once more, but for the opposite reason to the case described in the paragraph above.

Of course it can also be argued in the world of men and women, rather than figures or things, that these workers are unionised and that a high degree of solidarity. Hence by their actions they defend their monetary wages which remain unaltered. In that case the cost price in Capitals 2 and 3 will increase as they have to increase their variable capital and the cost price in Capitals 1, 4 and 5 will decrease as they spend less on variable capital. These alterations in variable capital will either raise or lower cost prices. This in turn will alter the redistribution of the profits between these five capitals

yielding different prices of production to the ones listed above in Table 5. We show the effect below but limit it merely to the effect on cost price. Changes in wages is dealt with by Marx in Chapter 11. In Table 8 we keep labour simple and undifferentiated and at its original value.

Table 8.

Capital	c	v	new cost price	previous cost price (Table 5)
1	23.1%	20	67	72
2	23.7%	30	78	74
3	24.4%	40	89	76
4	19.6%	15	55	61
5	9.3%	5	24	29
	<u>202</u>	<u>110</u>	<u>312</u> (rounded off)	<u>312.</u>

Having demonstrated the effect of keeping money wages constant, we return to our earlier solution in Table 6. In the interest of keeping the solution balanced it is best we ignore these ancillary observations so that the total capital and the consumed capital appreciate and depreciate in a related manner. By doing this we alight on a phenomena actually found in capitalist economies, the movement in the price of labour power that copies the movement in the real world and helps explain it.

In the real world wages tend to be higher in higher composition capitals because workers there set in motion relatively more means of production. This implies an increased level of skill or intensity of labour or responsibility and therefore a higher wage. Had our table proved the opposite, namely that wages rose in low composition capitals and fell in higher composition capitals then our table would have had to be abandoned as unearthly.

Similarly with the capitalists. Unequal exchange will swell some of their capitals in monetary terms and shrink others. Some will spend a bigger proportion of their capital and others a smaller proportion on reproduction compared to an earlier stage. However, the same quantity of means of production will be set in motion by the same number of workers, and the same amount of means of production and labour power will be consumed as before.

Earlier we understood why the price of production of capital 5 had to be 54 and why it had to differ from the commodity price of 37. We have therefore shown it is entirely possible to maintain all the invariances by treating individual capitals as aliquot parts of the whole and to appreciate or depreciate them in their entirety in accordance with Marx's theory of reproduced labour time. (In doing so we merely follow Marx's examples in Chapter 11 and elaborate on and develop his method which is to be found there.) In the real world, the price of production which we obtained will be impermanent, as the variation of prices will soon change the demand for each product and with it the conditions of production. With demand altered, some capitals will physically increase production and some will be forced to shrink their production putting an end to our example as these capitals will no longer be of equal magnitude in terms of value.

In concluding this part we can now return to Marx's rider that the transformation problem cannot proceed on the basis that all of the capital is consumed each year regardless of its composition. By not doing this we have revealed something remarkable. We have noted how it is that the high composition capitals have appreciated at the expense of the low composition capitals. Intuitively we would have thought it would be the labour intensive capitals that would have grown because they have, organically, a higher rate of profit due their relatively large labour force. And yet, because of the

direction of unequal exchange, a direction that advantages the higher composition capital, it is they who expand at the expense of low composition capitals.

That is why production moves from horse drawn carts to steam trains and not the other way round. It is why capitalism is able to develop the forces of production which is always based on an increase in the technical composition of capital with each worker now setting in motion more means of production. But while unequal exchange allows for this, it does not overcome the fundamental contradiction at the heart of this process, where the averaging out of the rate of profit is met by a tendency for this very rate to fall as the ratio between past labour and living labour increases.

Section 2. Solving the problem between embodied and reproduced labour time.

We have seen in Part 1 how competition between industries yields a single oscillating average rate of profit between industries. In this section we will examine how competition results in a single market price.

We began by emphasising the difference between embodied labour times and current labour times. While they may not differ, particularly if the time interval is short, more often they do differ. Firstly productivity changes. The same commodity today may cost less labour time to produce than previously. Let us say from 10 hours down to 9 hours or by 10%. That means the labour time embodied in older commodities produced, but not yet exchanged (in storage) is reduced by the same 10% much to the lament of their owners. Secondly natural variations in say climate or mining conditions (seam thickness and accessibility) may have intervened. A good growing season produces a bumper crop. The same labour time is now represented by more tonnage of crop. Its value drops and this devalues the remnants of last year's crop grown under less suitable conditions, say lack of rain.

So far so good. When Marx dealt with capital in general where everything was simple, matters were clear cut. When we traverse from capital in general to many capitals, from simplicity to complexity, from value to price, we will find matters are not so clear cut. The complexity of many capitals, most of which are different, we will find leads to a synthesis of embodied and reproducible labour, a true dialectical relationship, ever changing.

Marx's description of market value, the most complex and developed description of social value takes place in Chapter 10. This Chapter is often overlooked due to the concentration on the transformation problem in the previous Chapter. This is unfortunate as these two Chapters have to be taken together in order to establish the relationship between value and price. Within the capitalist mode of production two distinct sets of unequal exchanges takes place. Chapter 9 between industries and Chapter 10 within a single industry. And as Marx points out, it is the latter set of unequal exchanges, that within a single industry that is first established historically. And it does so because prices of production requires a higher development of the capitalist mode of production. (page. 281).

We will now attend to the inequality in exchange that exists within a single industry. Just as we recognised that capitals of differing composition should yield different rates of profit, so within a single industry, capitals of differing productivity should yield different market prices. Within a given industry, each firm's individual value, its actual cost of production is unique, and potentially different to the rest of the firms in that industry. These individual values however cannot be expressed as individual prices. No product can sell at multiple prices. Those firms selling at higher prices will find no takers. Those selling at lower prices would be swamped with customers. The high sellers would be wise to reduce

their selling prices and the low sellers would be stupid not to raise their prices. In the end competition enforces a single price, the market price.

It is the same when we look at value. All the individual values present in a particular industry can be homogenised into a single value – the market value. For example if there are only three firms in an industry making identical steel pots there will only be three individual values. Let us say 20, 30 and 40. The average here would be 30 (90 divided by 3). If each of the three firms produced an equal number of steel pots the average would remain at 30 which could potentially be the market value but may not.

It is too soon to answer that question. Before we can, we have to look at how many steel pots each of the three firms produce which as expected are different. The first produces 400 steel pots, the second 200 while the third produces 100. In total they produce 700 steel pots. The value of the steel pots produced by the first firm amounts to £8000 (£20 x 400) the value of steel pots in the second firm is £6000 (£30 x 200) and in the third firm it is £4000. Together this adds up to £18,000 represented by 700 identical steel pots. The average is now £25.71 or £4.29 lower than the previous average of £30.

We call £25.71 the weighted average and that is the **market value** in the steel pot industry. A weighted average (£25.71) differs from a simple average (£30) because it also takes into account the weight of production in the steel pots industry. In that industry we find that the company that produces at the lowest value (£20) also produces the most steel pots (400). It is the biggest factory of the three. And so because the production of the cheapest steel pots outweighs the other firms, it reduces the weighted average below the simple average. The simple average looks at only one steel pot produced in each firm, while the weighted average measures the labour time in all the steel pots.

The weighted average forms the market value because this is the only value, which when multiplied by the quantity of steel pots, yields the total labour time expended in that industry. £25.71 times 700 equals £18,000 (total value) while £30 x 700 equals £21000 (which is larger than £18,000). A simple average will yield the correct result only if the more productive firms match the less productive firms, such that their differences cancel each other out. This is most unusual. In reality, an industry is either composed of a preponderance of more efficient firms, or a preponderance of less efficient firms, so that weighted averages either sit above or below simple averages.

But we need to go further. Any product, even a steel pot, is composed of more than the living labour that gives it its shape and form. It requires a building, machinery, raw materials and electricity amongst other things. All these have already been produced. They are products of already expended labour, in effect past labour. So to make a steel pots requires living labour and past labour. Weighted averages apply as much to past labour, as it does to living labour.

Any reductions in the time needed to produce a steel pots affects its market value. Any reductions in labour time needed to produce the machines, the materials or the power needed by living labour to produce a steel pot reduces the market value. Hence the market value of the steel pots will change, when the weighted average of living labour (time) changes and/or the weighted average of the past labour (time) changes. This then is the more complex synthesis of value, its ultimate social form as described in Chapter 10.

This has caused so much confusion we need to ensure this distinction is well understood. When Marx was dealing with capital in the abstract as a single average capital matters were simple as we discussed earlier. If the average steel pots took 10 hours to produce last year and if it now takes only 9 hours this year because of rising productivity, then any steel pots remaining over from last year are treated as if they were produced today. They are valued not at 10 hours but at 9 hours labour time.

In the real world, the complex world, the world of many capitals, all different, we are no longer dealing with a single value but a weighted average value. Socially necessary labour times take the form of a weighted average labour time for that product, both past and present. Looking at the matter in figures, the difference will soon become clear.

First, capital in general which utilises simple averages. If the average time needed to reproduce a single steel pot falls by 10%, so too will the value of all the steel pots in the market. But that fall is different when we consider the matter as a weighted average. Here the fall can be anywhere between 0% and 10%. It depends on the weight of change. If the weight of the change is 100% then the fall would be 10%. Anything less would result in a fall of less than 10%.

Let us take a living example by examining the steel that goes into making the steel pots. We assume the market value of steel equals its market price. World steel production in 2012 as described by Ernest and Young, amounted to 1.6 billion tons. For simplicity we will assume a price of \$700 per metric ton of carbon steel (this is the cheapest steel but never mind). This yields a turnover of at least \$1,120 billion. Again according to Ernest and Young profit margins vary between 12 and 18% with an average around 15%. Total gross profits in the industry therefore amount to around \$168 bn.

Let us say that a new technique of production is discovered by one of the 30 odd world size steel firms. This firm accounts for 5% of world steel production. Its turnover is equivalent to \$56 billion. Its weight in the industry is only one twentieth of the entire industry. It finds a way to produce steel with a saving of 30% in labour time. Does that mean the whole industries labour time is reduced by 30%? Of course not. Only one firm has changed.

If prices were to fall by 30% across the entire industry, the turnover of that industry will fall by \$336 billion. That would wipe out the unadjusted profit margin of \$168 billion. Every company except the one that introduced the new technique would be plunged into losses. Reproduction would break down because the steel industry has become insolvent. The reproduced market value cannot therefore fall by 30%.

No, what really happens is that the market value does not fall by 30%. It would have fallen by 30% if the weight of change in the steel industry was 100%, if every steel firm had adopted the new technique simultaneously. But the weight of change is only 5% or one twentieth of the production. The fall in the market value would thus be far less than 30%. It is in fact 1.5% (one twentieth of 30% equals 1.5%). This is the weighted average, 95% unchanged and 5% changed.

Because the price has fallen by 1.5% from \$700 to \$690 there is a loss of revenue to the industry of \$16 billion. There is thus a loss of profit of around \$2.4bn. However in the case of the firm that introduced the new technique that loss is more than compensated for by the reduction in its value of 30%. Everything being equal it will make an extra margin of 25% and therefore a super profit. Its super profit is at the expense of the rest of the industry who now make lower profits. Our firm is advantaged by unequal exchange and as a result there is a redistribution of surplus value in the steel industry. They make less profit, it makes more profit.

As far as the steel pots makers are concerned, the fall in the market price of steel of 1.5% reduces their cost prices. The total labour time needed to make a steel pot falls in the same way it would have fallen had the steel pots' factories increased the productivity of their workers. Its share of the labour time of society has fallen because of the fall in the labour time needed to make the steel its workers use to make steel pots

Returning to the steel industry, we can assume that the rest of the industry is quick to find out that one of its members is making super profits while their profits have declined and so they too will invest in this new technique of production. As more and more do, so the weight of production utilising this technique of production goes up. If 50%, half, now use this technique we can assume the market value will have fallen by 15%. (Half of 30%)

So when we refer to market value, we are referring to dynamic weighted averages that respond to changes in the labour times, both in the now and in the past, because we are concerned only with reproduction labour times and to embodied labour times only in so far as their weight remains unchanged. In other words weighted averages mean incremental changes not a single absolute change. That is the essential difference. If Marx was dealing with the steel industry as capital in general that is abstractly, by viewing it as a single average capital then yes the drop would be a single 30%. **Similarly if we were to say the market value falls by 30% then the market price too will fall by 30%** but it is most unusual for the market value, that is to say the weighted average value of all the firms in the industry, to fall in one fell swoop as this implies all the firms in that industry act as one and introduce this new technique of production as though choreographed.

Market value or social value is therefore a concrete expression of diverse labour times, and not a single abstract labour time. This confusion has bedevilled those who have tried to explain Marx and those who have criticised him. However though Marx does not use the word weighted average times to express market value it is clear his examples and methodology in Chapter 10 amount to the use of weighted averages. Weighted average is the ultimate expression of value and in future when we talk of value we mean the weighted average labour time that is currently needed to reproduce a given commodity.

The debate over price and value is not a debate over ideas. It is not an academic exercise. We are preparing for the future, a world without capitalism. To replace the profit motive we need to develop a pricing system capable of developing our socialist economy in its transformative years. And we cannot do so if we do not understand prices under capitalism and its relationship to underlying value, or what is the same thing – the actual cost of production.

(Note 1.)

The honourable exception is Anwar Shaikh's notable transformation solution (1977) though it does not include the repricing of capital.

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