1 The transformation procedure: a non-equilibrium approach

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1.1 INTRODUCING SOME BASIC CONCEPTS AND RESULTS

The method of research and the results of this chapter's inquiry diverge considerably from the well established discussions of the transformation procedure.[1] It is thus possible that the reader might have some initial difficulties in following the train of thought to be developed below. This first section is meant to highlight the red thread running through this chapter. This section is not meant to submit logical proofs (this will be done in the following sections) but only to acquaint the reader with an approach which diverges substantially from the mainstream discussion of Marx's transformation procedure. This is the reason why in this section the basic features of this chapter will be stated rather than argued for.

The transformation procedure is the core of the Marxist theory of price formation. It is characterized by four basic features. First, it explains *both a real and a tendential redistribution of value*, the process through which (more or less than) the value both transferred and newly produced is *actually* realized by each commodity (actual redistribution) and the process through which the value actually realized is *tendentially*, that is hypothetically, redistributed (tendential redistribution). Second, the tendential redistribution is explained not only in terms of *capital movements* (which tendentially equalise the rates of profit) but also in terms of *technological change* (which tendentially equalise the value of the inputs). Third, there are two aspects to the process of transformation, the *quantitative* and the *qualitative*. And finally, the transformation procedure depicts a *chronological process*, a succession of production and distribution periods.

Let us first of all distinguish between the quantitative and the qualitative aspects of the transformation. Quantitatively, transformation means redistribution of value. This is the aspect on which the commentators have focused their attention. Qualitatively, this approach is based first of all on the chronological succession of production and distribution periods. As such it is the very opposite of the equilibrium approach which has been surreptitiously smuggled into Marx's transformation procedure and generally accepted. Moreover, this chronological

perspective is paired with a dialectical one. This means that the process of price formation (and thus the transformation process as well) is seen as a constant change of individual into social values and of social values back into individual ones.[2] More specifically, there is a qualitative change either from potential social values (that is individual values) to realized social values or from realized social values to potential social values (that is individual values) every time a commodity is sold, even though there is not necessarily a quantitative change, a redistribution of value. In turn, the actually realized social values can be transformed into tendential social values. Let us then introduce the chronological dimension.

Consider a period, t_1–t_2, and two commodities, *a* and *b*. Commodity *a* is bought at t_1 and enters t_1–t_2 as an input of *b*. Commodity *b*, the output, is immediately sold at the end of t_1–t_2, that is at t_2. The steps to be highlighted can be followed by referring to Figure 7.1.

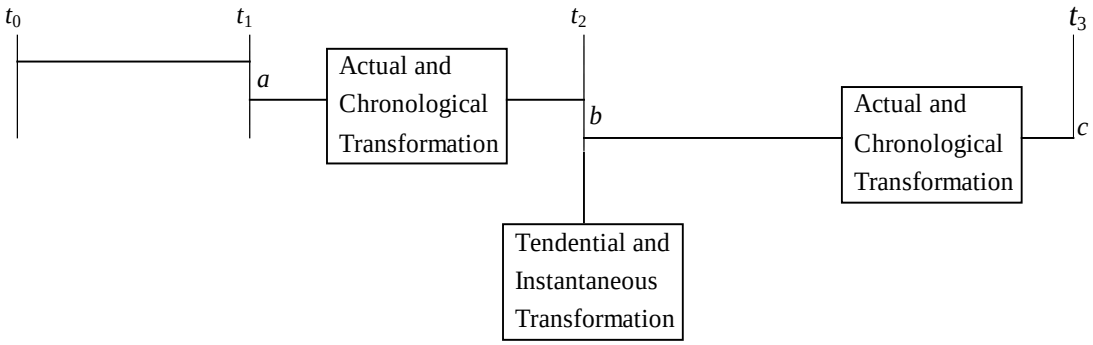


Figure 7.1 Actual and tendential transformations

Consider the input *a* first. At t_1 the input enters the t_1–t_2 period. Quantitatively, the value at which the input *a* enters t_1–t_2 is the value actually paid for it at t_1 as an output of the previous production period, t_0–t_1. This value is the *market price* of *a* at t_1. At t_1 this is a given. This is also the *value transferred* from *a* to *b*. Qualitatively, the *individual value* of the inputs (what has been paid for them as outputs of the previous period) is at the same time their *potential social value*, which may or may not realize itself, according to whether the commodity *b*, in which *a* is incorporated, is sold or not at t_2.

Time t_2. Quantitatively, what the producer of *b* has paid for *a* at t_1 is not necessarily what that producer realizes at t_2 for having used *a*. This depends on what the market is willing to pay the producer of *b* for having used *a*. For example, technological changes in the production (and thus in the value) of *a* intervening before *b* is sold at t_2 affect the market price of *b*. Qualitatively, it is only at the moment of, and through, the sale of *b* at t_2 that the value contained in *a* (its individual, or potential social value) is realized as part of the value contained in *b*. This is the *actually realized social value* of *a* at t_2.

Time t_2 again. At this point, it is possible to compute the value tendentially realized by *b* for having used *a*. As it will be argued below, this is the *reproduction price* of *a* at t_2. Quantitatively, this is equal to the constant and variable capital which has been invested at t_1 by those capitals which, at t_2, operate under conditions of average productivity. Qualitatively, at t_2 it is possible to theorize (as opposed to compute) the social value tendentially realized by *b* for having used *a*. This is the result of a real movement, technological competition. It is this latter which lends an economic content to that average which is the reproduction price of the inputs.

Consider now the output *b*. Quantitatively, the value contained in *b* before sale at t_2 is the market price of *a* at t_1 plus the surplus value produced during t_1–t_2. Qualitatively, the value contained in *b* is its individual value which is also its potential social value. In fact, the value which has been produced may or may not realize itself according to whether *b* is sold or not.

Time t_2. Quantitatively, the value both newly produced and transferred during t_1–t_2, that is the value contained in *b*, is not necessarily the value actually realized by the producer of *b* at t_2, when *b* is sold. This is *b*'s market price at t_2 and is usually different from the value contained in *b*. Qualitatively, it is society which, by buying *b* or not, decides at t_2 whether *b*'s value contained, or potential social value, realizes itself as an actual social value or not.

Time t_2 again. At this point, the point of sale, it is possible to compute the value tendentially realized by *b*. This is its *production price*, or the sum of the *re*production price of *a* plus the average rate of profit computed on that reproduction price. This is the quantitative aspect. Qualitatively, this is the transformation of the actually realized into the tendentially realized social value. Here too, the economic significance of this transformation is due to the fact that it rests on a real movement, capital movement and technological competition. It is due to this movement that it is possible to theorize the tendential equalisation of profit rates and the value of the inputs.

At t_2, then, there is an actual transformation, an actual redistribution of value. It is at this point that the production price can be computed on the basis of the actual values, or market prices. Or, the production price is a notion which applies only to the outputs, not to the inputs. It is a tendential price, not an actual one. It is a price which tends to emerge when the outputs are sold but which actually never emerges. As such it can be known only through computation.[3] Nevertheless the production price is real, is part of reality, because it is the result of a double real movement, capital movement and technological change. Due to capital movements, the surplus value actually realized at t_2 can be hypothetically redistributed through sectors in such a way that each capital realizes the same, the average, rate of profit. Due to technological change, at t_2 the value actually realized for the inputs can be hypothetically redistributed into their tendential value, their reproduction price.

The quantitative aspects of the transformation can be summed up as follows. As far as inputs *a* are concerned, there is an actual transformation at t_2 from individual values (the market price paid for them as outputs of the previous period) to actually realized values (what the market pays the producer for having used that input) and a tendential transformation from these latter into reproduction prices (what the producer would realize for their inputs if they had used the average productivity techniques). As far as outputs *b* are concerned, at t_2 there is an actual transformation from individual values, that is the market price of the inputs at t_1 plus the surplus value actually produced during t_1–t_2, into market prices (what the market actually pays for the outputs) and a tendential transformation of market prices into production prices (the average rate of profit computed on the inputs' reproduction price). Every time an output *b* exits a production process and is sold, the following tendential values can be computed: the reproduction price of its inputs *a*, the average rate of profit, and thus the production price of *b*, the outputs. However, that output does not enter a new process, t_2–t_3, at its tendential value, at its production price: rather it enters the new process at its actual value, the market price at which it has been sold at t_2.

Let us summarize the qualitative transformation. Commodity *a* enters t_1–t_2 at t_1. At this point it has both a social value, as an output of t_0–t_1, and an individual value, as an input of t_1–t_2. Lack of understanding of this point has been the source of much confusion. Quantitatively, at t_1 *a* is sold as an output of t_0–t_1 at the same market price at which it is bought as an input of t_1–t_2. But qualitatively, at t_1 *a* has both a realized social value (as an output) and an individual value (as an input). Let us now proceed to the next step. During t_1–t_2 there is both an actual and chronological transformation, that is an actual production and distribution of value taking place between two points in time, t_1 and t_2, and continuing into the next period, t_2–t_3. At t_2, the individual value, which is the potential social value, of the output *b* is transformed into its actual social value, its market price. At this point it is possible to compute its tendential social value, its production price. This is a hypothetical and instantaneous transformation. Consider now the next period. At t_2 the realized social value of *b* as an output of t_1–t_2 becomes qualitatively the individual value of *b* as an input of t_2–t_3, even though quantitatively the market price at which *b* is sold is obviously the same as the market price at which *b* is bought. Qualitatively, then, there is a continuous transformation of individual into actual social values and back from these latter into individual values every time a commodity is sold. But, at any point at which the outputs are sold, it is possible to compute the price towards which the actual social values tend, the production prices.

Figure 7.1 summarizes the basic concepts introduced above. It is meant to assist the reader, should the meaning of any of these concepts be lost sight of in the following sections.

1.2 INDIVIDUAL AND SOCIAL VALUES

In Marx's computation of prices of production, the outputs' production prices are calculated by adding to the prices of the inputs (means of production and labour power) the average rate of profit,[4] rather than the rate of profit corresponding to the value actually produced and realized by each capital, the actual rate of profit. It is in this sense, through the substitution for each capital of the average rate of profit for the actual rate of profit that the (not yet transformed) 'values' are transformed into (the transformed) 'prices', that is into production prices. As is well known, this transformation procedure has been the object of sustained criticism, especially by authors in the neo-Ricardian tradition. One of the two major criticisms has focused on the supposed circularity in Marx's reasoning.

The 'circularity critique' objects that the outputs of a certain production process are the inputs of another process. As inputs, they are not appraised at their production prices, given that, as far as the inputs are concerned, the actual rate of profit has not yet been replaced by the average rate of profit. But as outputs they are appraised at their production price. That is, the same commodities are appraised at their 'value' as inputs of a certain process and at their 'price' as outputs of another process. Or, the same commodities are bought as inputs at one (not yet transformed) value but sold as outputs at another (transformed) value, the production price. This, it is held, is a logical inconsistency given that, at any given point in time, a commodity is bought by someone (as an input) and sold by somebody else (as an output) at one and the same price.[5]

As Carchedi (1991, Chapter 3) has shown,[6] this critique rests on a logical mistake: it ignores the *chronological succession* of production and distribution cycles, thus wiping time and reality itself out of economic analysis. The basic point is that the output of a certain period, for example t_0–t_1, becomes the input of the *following* period, for example t_1–t_2. Suppose that the output of t_0–t_1 is commodity *a*. This commodity enters as an input the next production period t_1–t_2 which produces commodity *b*. At t_2 *b* is sold. This is shown in Figure 7.2 which sets the correct frame for the appreciation of Marx's transformation procedure.

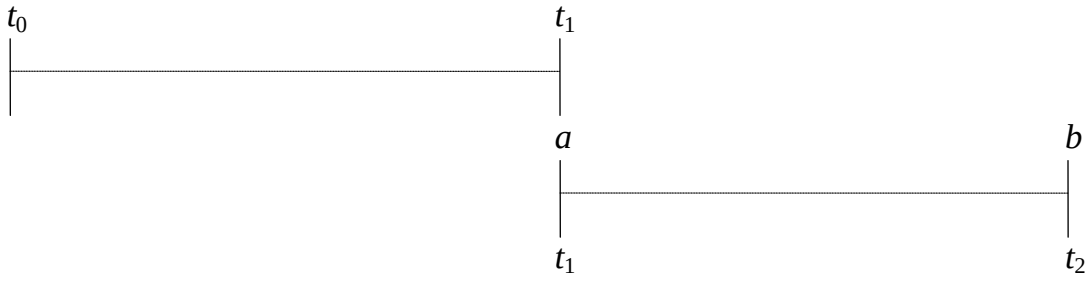


Figure 7.2

Having introduced the chronological dimension, we can now introduce another of the basic features of Marx's transformation procedure, the distinction between social value and individual value (1976a: 434). The terminology is Marx's own:

> The real value of a commodity, however, is not its individual, but its social value; that is to say, its value is not measured by the labour-time that the article costs the producer in each individual case, but by the labour-time socially required for its production.

In other words, the *individual* value is the value a commodity has acquired during the production process. This is not necessarily the *social* value, the value that commodity realizes when it is sold. The social value can be either the value actually realized or the value tendentially realized. It follows that the individual value is only a *potential* social value and that the social value is an actually or tendentially *realized* individual value. Moreover, since the labour time a commodity realizes is the labour time society adjudicates to it at the moment of, and through, exchange, the individual value is the value that commodity has before it is sold and the social value is the value that commodity realizes at the moment of, and through, exchange.[7]

Four key terms have been introduced: potential, realized, actual and tendential. An individual value, the value contained in a commodity, is a potential social value because that value has not been realized yet through the sale of that commodity. It is only when the commodity is sold that the value contained in it, its potential social value, becomes value actually realized. The tendentially realized social value of that commodity is the value towards which the actually realized social value, and not the potential social value, tends. Only actually realized elements of reality can move (tend) towards a tendential situation. If this is so, the transformation process is first of all the transformation of individual into actual social values and from social values back into individual values, that is the transformation of potential social values into actual social values and vice versa. This is the *actual transformation*, the emergence of actual social values (market prices) from potential social values (individual values) and the subsequent change of market prices into individual values.

It is only after this has been understood that the *tendential transformation* can be properly framed. This is the transformation of actual social values (market prices) into tendential social values (production prices), the theoretical expression of the fact that market prices tend towards production prices, those prices at which the actual rates of profit are equalised into an average rate of profit. There is no direct transformation of 'values' into 'prices', or of individual values into production prices, as it is almost unanimously thought. Rather, the transformation of individual values into production prices passes through the emergence of market prices, the actual prices. The chain of logical causation is an actual transformation of individual (potential social values) into actual social values (market prices) and a tendential transformation of the actual social values (market prices) into tendential social values (production prices). *This* is the transformation

process, and these are the two inseparable aspects (the actual transformation and the tendential transformation) of that process.[8] If IV stands for individual values, MP for market prices, and PP for production prices, then equations 1 below depict the wrong perception of the transformation procedure

$$\begin{aligned} \text{IV} &\rightarrow \text{PP} \\ \text{IV} &\leftarrow \text{PP} \end{aligned} \qquad (1)$$

and equations 2 below depict the complete process of transformation, which is also the essence of a Marxist theory of price formation

$$\begin{aligned} \text{IV}(t_0) \rightarrow &\text{MP}(t_1) \rightarrow \text{PP}(t_1) \\ &\text{MP}(t_1) \rightarrow \text{IV}(t_1) \\ &\text{IV}(t_1) \rightarrow \text{MP}(t_2) \rightarrow \text{PP}(t_2), \text{ and so on} \end{aligned} \qquad (2)$$

where the arrows indicate the direction of transformation and t_0, t_1 and t_2 indicate different and subsequent moments in time. Relation 2 depicts this chapter's thesis in a nutshell: at each moment in time, the market prices (actually realized social values) of the outputs emerge from their individual values (values contained) and *immediately* tend towards their production prices. In terms of Figure 7.2 above, the market value of *a* as an output of t_0–t_1 becomes the individual value *a* has as an input of t_1–t_2. This market price becomes an element of *b*, the next outputs' individual value. This latter will be transformed into *b*'s market prices at t_2, the time of *b*'s sale. If *b* enters t_2–t_3 as an input, the process repeats itself. In order to argue for this thesis, we shall first consider the actual transformation, the emergence of the market prices from individual values and their transformation back into individual (potential social) values. In terms of Figure 7.2, this is the emergence of the market price (actual social value) of *b* as an output of t_1–t_2 from its individual (potentially social) value at t_2 and this market price's change into an individual value, also at t_2, as an input of t_2–t_3. This is the object of section 3. Section 4 deals with the tendential transformation, that is with the tendency of the market prices of outputs towards production prices and of inputs towards reproduction prices, also at t_2.

1.3 THE ACTUAL TRANSFORMATION

Our first step will be to apply Marx's distinction between individual and social value both to the inputs and to the outputs of a production process. We shall refer to Figure 7.2. Let us begin with the outputs, that is with *a* as an output of t_0–t_1. The actually realized social value of *a* as an *output* of t_0–t_1 is the value *a* realizes at the moment of, and through, sale, that is at t_1. It is its market price. After having been sold, a commodity can be sold and bought again. Every time it is bought and sold, the individual value is the value for which it as been bought and the actual social value is the value at which it is sold. The difference between the value contained and the value actually realized (market price) is due to the fact

that the latter is determined not only by the former but also by the demand for that product.

Consider now *a* as an input of t_1–t_2. At t_1, *a* is sold as an output of t_0–t_1 at its actually realized social value, that is at its market price, and is bought as an input of t_1–t_2 at the same quantitative value. There is no quantitative difference between the value at which *a* is sold by someone as an output of t_0–t_1 and the value at which *a* is bought by somebody else as an input of t_1–t_2, *pace* the neo-Ricardian critique. However, there is a qualitative difference. Qualitatively, the actually realized social value of *a* as the output of t_0–t_1 becomes again *a*'s individual (potential social) value as an input of *b*, as an input of t_1–t_2. The reason is the following. Once *a* enters t_1–t_2 as an input, its value becomes again a potential value both qualitatively (because it will realize its value only if at t_2 the output in which it is incorporated is sold) and quantitatively (because this value is not necessarily equal to the value *a* will actually realize at t_2, when *b* will be sold).

At t_1, then, a qualitative transformation takes place, from *a*'s actual social value as an output of t_0–t_1 to *a*'s individual value as an input of t_1–t_2. However, this qualitative transformation is concealed by the fact that quantitatively the two prices coincide. At t_2, there is again a qualitative transformation, from *a*'s individual value as an input of t_1–t_2 to *a*'s actual social value also as an input of t_1–t_2. Now, however, there is also a quantitative transformation. In fact, at t_2 the producer of *b* realizes *a*'s actual social value and not necessarily what has been paid for *a* at t_1, its individual value. Thus, the individual value of *a* as an input of t_1–t_2 is the value it has when it enters this period t_1 and it corresponds quantitatively to the actual social value (the market price) it has as the output of the previous period, t_0–t_1. The actually realized social value of *a* as an input of t_1–t_2 is the value *b* realizes at t_2 for having used *a* as its input. To sum up, the actually realized social value of *a* as an output of t_0–t_1 is its market price at t_1. The individual value of *a* as an input of t_1–t_2 is quantitatively equal to its actually realized social value as an output of t_0–t_1. The actually realized social value of *a* as an input of t_1–t_2 is what the market pays the producer of *b* for having used *a*.

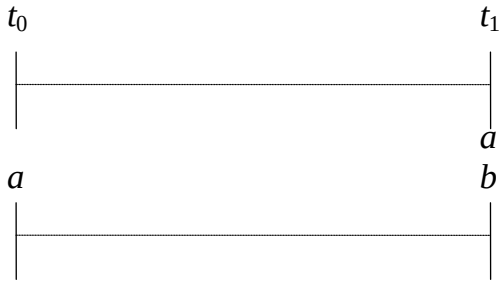
The dialectical movement of value distribution at the moment of sale (the actual transformation process) is a continuous process of transformation. At t_1 the actual social value of *a* as the output of t_0–t_1 is transformed qualitatively into its individual value as an input of t_1–t_2, even if quantitatively these two values must be the same. At t_2 the individual value of *a* as an input of t_1–t_2 is transformed again (both qualitatively and possibly quantitatively) into its actual social value, that is into what the producers of *b* are paid for having used *a*. If, at t_2, *b* becomes the input in the next production period, t_2–t_3, the actual social value of *b* as an output of t_1–t_2 becomes again its individual value as an input of t_2–t_3. Again, this is only a qualitative transformation.

It is then clear that at t_1 *a* is sold as an output of t_0–t_1 and bought as an input of t_1–t_2 at one and the *same* price. Once one steps out of the static, unrealistic and timeless neo-Ricardian world into the dynamic, realistic and chronological

Marxian frame of analysis, the 'circularity critique' simply melts away. Nothing could be further from Marx's procedure than, as the circularity critique holds, the same commodity being sold by someone at its transformed (that is actual social) value and, at the same time, bought by someone else at its not yet transformed (that is individual) value. This applies also to the case in which *a* is both an input and an output of the same production process (that is steel needed to produce steel) during period t_1–t_2. Neither is its value at t_1 as an input equal (unless by chance) to its value at t_2 as an output, nor do the two values tend towards each other. If one chooses a dialectical, dynamic, approach, the equilibrium hypothesis must go.[9]

In considering the actual process of transformation, then, the supposed inconsistency, the supposed circularity in Marx's transformation procedure, is the result of the application of a static frame of analysis, in which the succession of production and distribution periods is ignored, to a procedure specifically conceived to account for this succession, that is to a procedure aimed at explaining a real-life, dynamic, process. If the sequence of production and distribution periods is abolished, t_0–t_1 and t_1–t_2 become two contemporaneous processes, as it can be seen by shifting t_1–t_2 under t_0–t_1. Then, given that the two processes (periods) are made to coincide and thus to become the same period, *a* becomes both the output at the end of a certain period and the input at the beginning of the same period, *a* becomes *at the same time* both the output of a process and the input *of the same process*. In this timeless dimension, *a* is sold by somebody at its transformed value and bought by somebody else at its not yet transformed value. This, however, is the realm of equilibrium analysis, not Marx's method.[10] This mistake is illustrated in Figure 7.3.

But the critique does not stop here. Even assuming there is no circularity in Marx's computation of production prices, that is even assuming a succession of chronological periods, the critics continue, to know the production price of an output we must know the production price of its inputs. But this requires that we know the production price of their inputs, and so on in an infinite regression in time. This is the 'infinite regression critique'.[11] It is clear that if this were sound, it would have to apply not only to Marx's transformation procedure but to any social phenomenon inasmuch as it is determined by other phenomena, both present and past. Social sciences, then, would become an endless quest for the origin, for the inquiry's starting point. However, this is not how matters stand. In fact, the choice of the starting point depends upon the scope and purpose of our research.



t_1 t_2

Figure 7.3

Suppose that, following the generally accepted tradition, we wanted to compute the production price of the outputs on the basis of the production price of the inputs.[12] In this case, if we wanted to find the production price of the output *b* at t_2 by adding the average rate of profit to the production price of its inputs, say *a*, it would be perfectly warranted to take the production price of *a* as given. If, for whatever reasons, we wanted to determine the production price of *a* as well, we would have to take the production price of its inputs as given. But, sooner or later, we would have to accept a starting point as given. Infinite regression is a figment of imagination based on a methodological blunder.

1.4 THE TENDENTIAL TRANSFORMATION

Section 3 has argued that Marx's transformation procedure is free both from circularity and from infinite regression. On the basis of these results, we can now tackle the second aspect of the transformation, the tendential one. This deals, in a nutshell, with the following question: how should the inputs be valued in the computation of the outputs' production prices? The almost unanimous answer to this question is: the inputs should be valued at their production prices.[13] Yet, consider Figure 7.2. The input, *a*, has been produced in the t_0–t_1 period and enters the t_1–t_2 period. Take the point in time t_1. Either we refer to the beginning of the period t_1–t_2, or to the end of t_0–t_1. In this latter case, *a* has a production price as an output of t_0–t_1, *not* as an input of t_1–t_2. The notion of production price, by implying a (tendential) redistribution of surplus value at the moment of, and through, sale, makes sense only at the end and not at the beginning of a production process. As an output of t_0–t_1, *a* can indeed be assessed at its production price. But as an input of t_1–t_2, at the beginning of a new production process, *a* has only an individual value which, to repeat, is quantitatively equal to the market price *a* has as an output of t_0–t_1. Consider now t_2. Again, the production price can be computed only on outputs, not on inputs. But at t_2 *a* is not an output, it is an input. It is this value which must be determined. Consider Table 7.1

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A_I	600+300+300	1200	1250	66.7 + 33.3	2	10	9	90
A_{II}	5000+3000+3000	11000	11100	62.5 + 37.5	1.67	8	80	640
A_{III}	400+300+300	1000	850	57.1 + 42.9	1.33	6	7	42
B_I	700+200+200	1100	1200	77.8 + 22.2	3.5	15	9	135
B_{II}	6000+2200+2200	10400	10400	73.2 + 26.8	2.73	10	82	820
B_{III}	500+200+200	900	800	71.4 + 28.6	2.5	5	7	35
Total		**25600**	**25600**					

Table 7.1 Actual values

Table 7.1 is made up of two sectors, each of which is subdivided into three capitals with different levels of productivity (as indicated by the organic compositions of capital within sectors). Column 1 indicates value composition of capital, column 2 the value produced, column 3 the value actually realized (arbitrary figures), column 4 the constant and variable capital as percentages of the capital invested, column 5 the organic composition of capital, column 6 the output per unit of capital invested, column 7 the units of capital invested (1 unit of capital=100 units of value), and column 8 the total output. Capitals A_{II} and B_{II} are *average productivity capitals* (from now on, *APCs*). Let us now assume both capital mobility across sectors and technological competition within sectors. This is shown in Table 7.2.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
A_I	562.5 + 337.5 + 337.5	1237	8	9	72	1189	32.1%
A_{II}	5000 + 3000 + 3000	11000	8	80	640	10568	32.1%
A_{III}	437.5 + 262.5 + 262.5	962	8	7	56	925	32.1%
B_I	659 + 241 + 241	1141	10	9	90	1189	32.1%
B_{II}	6000 + 2200 + 2200	10400	10	82	820	10832	32.1%
B_{III}	512 + 188 + 188	888	10	7	70	925	32.1%
Total A+B		**25628**				**25628**	

Table 7.2 Tendential values under conditions of both capital movement and technological competition.

Under these conditions, technological competition tends to equalise both the value composition of capital and productivity. That is all capitals within sector A tend to invest 62.5 per cent in constant capital and 37.5 per cent in variable capital (see column 4 in Table 7.1), thus producing 8 units of *a* per unit of capital; similarly, all capital within B invest tendentially 73.2 per cent in constant capital and 26.8 per cent in variable capital thus producing 10 units of *b* per unit of capital invested. The movement through which each capital tends to overcome the others (some jumping ahead of the others, some others being overtaken by the more dynamic ones) means that at each point in time all capitals tend towards an average level of productivity.[14] In Table 7.2, column 1 gives the tendential value composition of capital (for example, A_I invests tendentially 62.5 per cent of 900 in constant capital, that is 562.5), column 2 gives the value tendentially produced on the basis of a rate of surplus value equal to 100 per cent, and column 3 gives the tendential output per unit of capital invested. This is the productivity of the average productivity capitals for all capitals. Column 4 gives the units of capital tendentially invested and column 5 gives the tendential output for each capital.

Before explaining the remaining columns, let us compute the average rate of profit. This is $\pi = (6228/19400) = 32.1$ per cent which is tendentially realized by *all* capitals. What will the production price per unit of output be? Let PP_a and PP_b be the two production prices per unit of output. Then, under these conditions, it does not matter on which capital's inputs the production prices are computed. For example,

PP_a = (900 + 900 × 0.321)/72 = (8000 + 8000 × 0.321)/640
= (700 + 700 × 0.321)/56 = 16.51

Similarly, PP_b = 13.21. Column 6 gives the value tendentially realized. This is obtained by multiplying in each sector the tendential price, or unit production price, by the tendential output, given by column 5. For example, A_I realizes tendentially 16.51 × 72 = 1189. Column 7 gives the rate of profit tendentially realized. For A_I this is (1189 – 900)/900 = 32.1 per cent. This is the same for all capitals.

Two points emerge from Table 7.2. First, technological competition is just as necessary as capital movement for the tendential equalisation of the rates of profit of all capital.[15] Second, all capitals within sectors tend to invest the same proportion of constant and variable capital as the APCs, that is to adopt the same technique, and thus the same productivity, as the APCs. Thus, tendentially, all A's tendentially invest $62.5_C + 32.5_V$ and produce 8 units of output per unit of capital invested, and all B's tendentially invest $73.2_C + 23.8_V$ and produce 10 units of output per unit of capital invested. If all capitals tendentially realize the average rate of profit on the capital tendentially invested, then all A's tendentially realize the average rate of profit on $62.5_C + 37.5_V$ and all B's tendentially realize the average rate of profit on $73.2_C + 26.8_V$. But since this capital is simply the capital actually invested at t_1 redistributed according to the proportions of the APCs, non-APCs tendentially realize the sum of constant and variable capital actually invested at t_1 but in different proportions. Only the APCs tendentially realize both the sum of the capital actually invested and its constant and variable parts as they have been actually invested at t_1.

In Table 7.2, A_{II} actually invests at t_1 5000_C and 3000_V. And B_{II} actually invests 6000_C and 2200_V at t_1. Other capitals tendentially invest, and thus tendentially realize, more or less than the constant capital actually invested and more or less than the variable capital actually invested by the APCs. For example, as a comparison between figures 7.4 and 7.5 shows, A_I actually invests 600_C and 300_V at t_1 but tendentially invests and realizes 562.5_C and 337.5_V at t_2. The value actually invested is equal to the value tendentially realized (900) but the proportion between its constant and variable parts changes. It is in this latter proportion that A_I tendentially realizes 900.

It is because all A's have been reduced to A_{II} and all B's to B_{II}, that the unit production prices, PP_a and PP_b, can be computed on any of the capitals within sectors. But this should not hide the fact that in each sector *the unit production price is the value invested by the APCs divided by their output*. Consider now non-APCs. If commodity prices within sectors tend towards the same unit production price, then not only the surplus value actually produced must tend towards the surplus value which corresponds to the average rate of profit but also the constant and variable capital actually invested must tend towards those tendentially invested, that is towards the constant and variable capital actually invested by the APCs at t_1. This is also the actual value, or market price, paid by

the APCs at t_1 for their means of production and labour power. Let us call this tendential value the *reproduction price* of the inputs at t_2. Then, the reproduction price of the inputs at t_2 is the *constant and variable capital actually invested at t_1 by the APCs*. This is also the *market price of the means of production and of labour power bought at (t_1) by the APCs*. It is by multiplying the reproduction price of the inputs by the average rate of profit and by adding to this result the reproduction price of the inputs that the value tendentially realized by the APCs is reached. And it is by dividing this value by the output of the APCs that the unit production prices are computed. It should be stressed that the assumption here is that there is no change in the technological structure between t_1 and t_2. This assumption will shortly be dropped.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
A_I	1237	8	9	72	1237	337	37.5%
A_{II}	11000	8	80	640	11000	3000	37.5%
A_{III}	962	8	7	56	962	262	37.5%
Total A	**13200**			**768a**			
B_I	1141	10	9	90	1141	241	26.8%
B_{II}	10400	10	82	820	10400	2200	26.8%
B_{III}	888	10	7	70	888	188	26.8%
Total B	**12429**			**980b**			

Table 7.3 Tendential values under conditions of technological competition only

Let us now consider the effects of technological competition (the tendential equalisation of techniques and thus of productivity) while temporarily suspending the effects of capital movements across sectors (the tendential equalisation of the profit rates). This is represented in Table 7.3.

In this table columns 1 through 4 are the same as in Table 7.2. Now, however, there is no equalisation of the profit rates across branches, given that the effects of capital movements are disregarded. However, there is an equalisation both of the profit rates within sectors and of unit prices, given that all productivities are tendentially equalised within sectors. How do we compute tendential prices and average profit rates? The total output in sector A is 768*a* (see column 4). The total value tendentially created in sector A = 13200, as indicated by column 1. Thus, the average unit price of *a* is 13200/768 = 17.19. This is what Marx calls the *market value* of one unit of *a*, or unit market value. Take now column 5. This is the value tendentially realized which, under these conditions, cannot but be equal to the value produced by each capital. For example, for A_I this value is $17.19 \times 72 = 1237$, and so on. Column 7 is the surplus value tendentially realized. For example, for A_I it is 1237 – 900 = 337. Column 8 gives the tendential rate of profit, that is 337/900 = 37.5 per cent. This is the same for all capitals within A. Let us compute now the unit market value for sector B. The average price for one unit of *b* is 12429/980 = 12.7. Thus, for B_I, the value tendentially realized is $12.7 \times 90 = 1141$. The tendential profit is 1141 – 900 = 241. The tendential rate of profit is 241/900 = 26.8 per cent. Similarly for B_{II} and B_{III}. There is an equalisation of the rates of profit within sectors but not across

sectors. In Table 7.3 too, the reproduction price of the inputs at t_2 is the constant and variable capital invested by the APCs at t_1.

Let us finally consider the opposite case in which only the effects of capital movements are considered, while temporarily suspending the effects of technological competition. This is shown in Table 7.4.

Consider for a moment Table 7.2 again. If all capitals within sectors tendentially invest in the same technique and thus reach the same level of productivity, they all sell their products at the same price. In Table 7.4, the first 5 columns give the actual value composition of capital, the value actually produced, the actual productivity (units of output per unit of capital invested), the actual units of capital invested, and the actual output, as in Table 7.1 above.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A_I	600 + 300 + 300	1200	10	9	90	1485	585	65%
A_{II}	5000 + 3000 + 3000	11000	8	80	640	10557	2557	31.96%
A_{III}	400 + 300 + 300	1000	6	7	42	693	–7	–1%
B_I	700 + 200 + 200	1100	15	9	135	1822	881	98%
B_{II}	6000 + 2200 + 2200	10400	10	82	820	11066	2620	31.96%
B_{III}	500 + 200 + 200	900	5	7	35	577	–238	–34%
Total		**25600**				**25798**		

Table 7.4 Tendential values under conditions of capital movement only

However, given that we abstract from the effects of technological competition, there is no equalisation of productivities and thus of unit prices and of the profit rates within sectors. But, if different capitals within sectors have different levels of productivity (as indicated by the different organic compositions of capital), either they sell their commodities at different prices, that is at prices such that they realize the same rate of profit, or they sell their commodities at the same price and realize different rates of profit. The latter is obviously the case: all commodities of the same type tendentially realize the same value (sell at the same price). Therefore, capitals with different levels of productivity tendentially realize different rates of profit. As Marx remarks

> We saw in the course of our argument how market value (and everything that was said about this applies with the necessary limitations also to the price of production) involves a surplus profit for those producing under the best conditions in any particular sphere of production. (Marx 1981:300)[16]

This means that above APCs tendentially realize more than the average rate of profit and that the opposite holds for below APCs. How do we compute these different rates of profit? We have seen above, in discussing Table 7.2, that the unit production price is computed by dividing the value actually realized by the APCs at t_2, which is computed on the basis of the reproduction price of the inputs and the average rate of profit, by their output. Once this unit value is known, we can multiply it by each capital's actual output. The outcome is the value tendentially realized by each capital. In Table 7.4, the average rate of profit is 6200/19400 = 31.96 per cent. If PP_a and PP_b are the unit production prices,

$$Pp_a = (8000 + 8000 \times 0.3196)/640 = 16.495$$

and

$$Pp_b = (8200 + 8200 \times 0.3196)/820 = 13.196.$$

It is on the basis of these unit production prices that the tendential rates of profit of the above and below APCs are computed. For example, for A_I the value tendentially realized (see column 6) is equal to 16.5 × 90 = 1485. By subtracting the value actually invested from this value, we obtain the surplus value tendentially realized, which for A_I is 585 (see column 7). Finally, by dividing this latter value by the value actually invested, we obtain the rate of profit tendentially realized (column 8) which, for A_I, is equal to 65 per cent.[17]

Table 7.4 is in line with the type of numerical examples dealt with by Marx in his discussion of the transformation procedure. Marx does not consider Table 7.2 because in it technological competition tendentially changes the organic compositions of capital and thus both the structure of production and the value created. But Marx is interested in the tendential redistribution of the value actually created and not in the tendential redistribution of the value tendentially produced. Therefore, he freezes, as it were, technological change. By so doing, he considers the situation exemplified in Table 7.4. However, it is Table 7.2 which depicts most consistently the tendential aspects of the transformation process.

Up to now we have considered the effects of technological competition on price formation under the assumption that no changes in the average technology, and thus productivity, occur between the beginning and the end of the period under consideration. We can now relax this assumption. Consider Figure 7.4.

In this example there are three categories of producers. Let us, for the sake of simplicity, define *a* as fixed capital only. Producers I invest *a* at t_0 which is the whole fixed capital needed to produce *b* in the two production periods t_0–t_1 and t_1–t_2. Thus, producers I produce *b* with a part of *a* during t_0–t_1 and start again with the remaining part of *a* at t_1 to produce again *b* during t_1–t_2. In period t_0–t_1 producers I are the APCs producing *b*, while in t_1–t_2 these producers are not the APCs any more because of producers II.

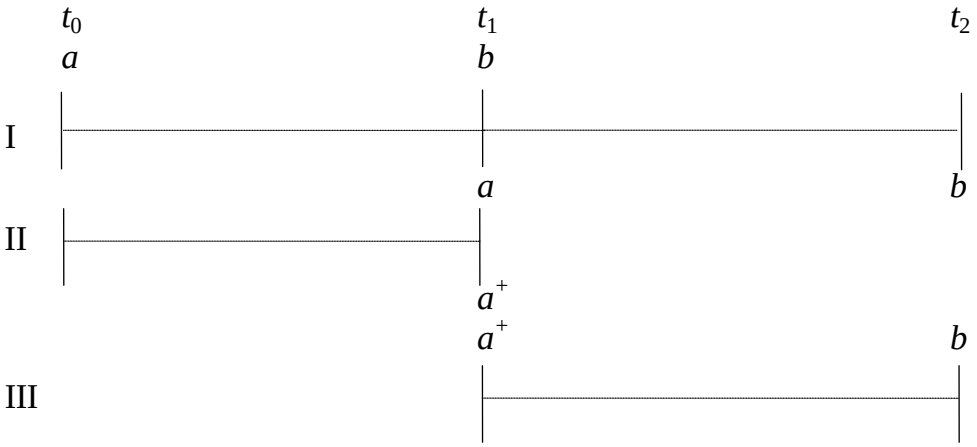


Figure 7.4 Effects of technological competition on value of stocks of fixed capital and on unsold commodities

Producers II produce a new *a*, or *a**, at t_1. This becomes the input used by the new APCs, producers III, that is by the competitors of producers I. At t_1, the stocks of producers I have an individual value equal to the market price paid for them at t_0 and this is the value transferred to *b* at t_1. At t_1 producers I tendentially realize the reproduction price of the stock used up during t_0–t_1 which is equal to the market price they, the APCs, paid for that stock at t_0. At t_2, producers I tendentially realize for the rest of that stock its reproduction price at t_2, which is equal to the market price paid by producers III, the new APCs, at t_1. A similar reasoning applies to producers I's stock of unsold commodities at t_1. In Marx's words, the social value of a commodity

> is to such an extent relative that when the labour-time required for its *reproduction* changes, its value changes although the labour-time really contained in the commodity has remained unaltered. (1972:129, emphasis added)

For example

> The introduction of power looms into England … probably reduced by one-half the labour required to convert a given quantity of yarn into woven fabric. In order to do this, the English hand-loom weaver in fact needed the same amount of labour-time as before; but the product of his individual hour of labour now only represented half an hour of social labour, and consequently fell to one-half of its former value. (Marx 1976a:129)

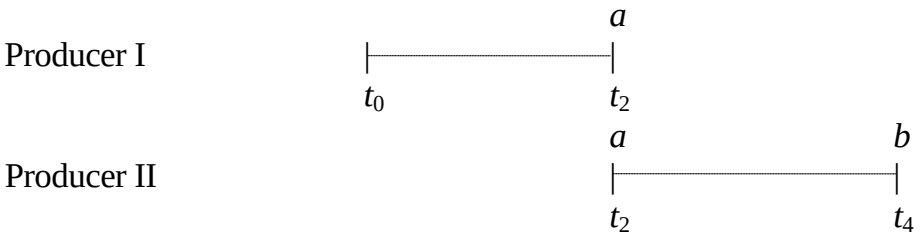
This case is important because it allows us to further specify the notion of reproduction price under realistic conditions, that is, under the assumption of technological change. Given the period t_1–t_2 and assuming that technological change takes place at t_1 as in Figure 7.4 above, the reproduction price, or value tendentially realized for the inputs at t_2 is the market price paid at t_1, that is, after technological change, for the means of production and labour power by those capitals which are the APCs at t_2, that is, the constant and variable capital invested at t_1 by those capitalists which at t_2 are the APCs. If we disregard change in the technological structure between t_1 and t_2, the *reproduction price* of the inputs, that is their tendential value at t_2, is quantitatively equal to the *market price which would be paid at t_2 for the means of production and labour power used by those capitals which are the APCs at t_2*. Thus if we had a coefficient transforming money prices into quantities of homogeneous labour hours, we could calculate the value tendentially transferred from the inputs to their outputs, and thus the value tendentially realized by those outputs for having used those inputs (that is the input's reproduction price) by dividing the market price of the inputs which would be used by the APCs at t_2 by that coefficient. Section 5 below will submit a method to compute such a coefficient. Here suffice it to say that there is no question of using simultaneous equations. Such prices are available empirical data which only need to be collected. Moreover, for the computation of the production prices of the outputs in value terms it is not necessary to compute the reproduction prices of the inputs also in value terms. The production prices in

money terms can be computed as in section 4 above. The application of the above-mentioned coefficient to these money prices gives the production prices in value terms.

The inputs are the result of past labour, they are congealed labour, so many hours of past labour which has been needed to produce them. But these hours of labour count for more or less hours if technology changes, if more or less labour time would be needed to produce those inputs at the time of the output's sale. Quantitatively, value is not simply hours of labour used to create a commodity. Rather, given t_0–t_2 with technological change at t_1, there is a social valuation of those hours of labour at t_2. Since this social valuation takes place at t_2, that is when the outputs in which the inputs are incorporated are sold, there is no need to go further back in time than t_1 to compute the social value of the inputs at t_2. That is, *the inputs transfer exactly their value to their output only in case of lack of technological change. In the opposite case, part of their value is appropriated by, and thus transferred to, other capitalists' outputs.* At the aggregate level, the principle of the conservation of value is maintained. Since Marx, propaedeutically, examines the transformation process abstracting from changes in the structure of technology, the wrong notion has arisen that the social value of a certain output of the previous period, say *a*, is always exactly transferred, when it becomes an input in the present period, to its own output in the present period, say *b*. But this holds only under exceptional circumstances.

It has been repeatedly stressed that the reproduction price is a tendential notion. It should be pointed out that there are in Marx two concepts of tendency, the future and past tendencies (Carchedi 1991:299-303). Present tendencies can be found by examining the real movement and asking the question: what would reality look like *now* if, given the *present movement*, only the tendency were to realize itself? The equalisation of the rates of profit into an average is a present tendency because it answers the question: what would the different rates of profit look like now, given the present actual rates of profit, if only the tendency (that is, the average rate of profit) were to realize itself? If the equalisation of the rates of profit is a present tendency, the other element of the production price, namely the equalisation of technologies within sectors, must also be a present tendency.

Here the question becomes: how much constant and variable capital would all capitals invest now, at t_2, if only the APCs existed now – at t_2 – given present prices? These are the prices, and thus the values, which would have to be paid by the APCs at t_2. Let us now consider a different example. Now we have 4 categories of producers, as in Figure 7.5.



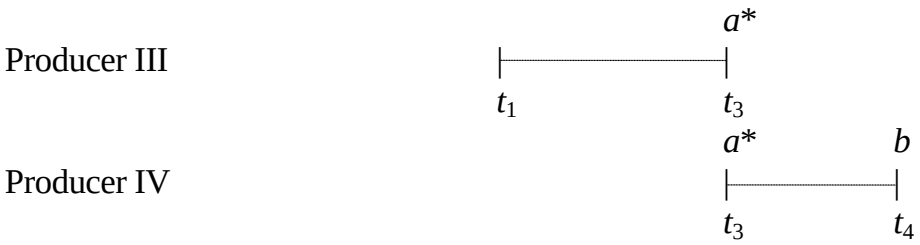


Figure 7.5 Effects of technological competition on value of fixed and circulating capital used up

Producers I produce *a* during t_0–t_2 and producers II produce *b* by using *a* during t_2–t_4. Suppose producers II are the APCs. Then the actual as well as the tendential price paid by producers II at t_2 for *a* is the market price *a* has at t_2. Suppose now that, before producers II complete their production cycle, say at t_3, a new category of producers, III, becomes the APCs producing a new type of *a*. Let us call this output *a**. This becomes the new input of *b*. Suppose that *a** reduces both the length of *b*'s production process, from t_2–t_4 to t_3–t_4, and the value of *a** *vis-à-vis a*. At t_4, the APCs producing *b* are category IV. Category II, then, tendentially realizes for its *a* the value of *a**. The fixed capital which is not realized by category II is realized by category IV. In both figures 7.5 and 7.6 there is a redistribution of value unless the commodities are not sold or the stock of inputs is not used because it has become obsolete. In this case there is destruction of value.

Notice the difference between the notion of reproduction price and that of *replacement price*. The former is meant to explain societal redistribution. The latter reflects the mentality of the individual capitalists. They consider the difference between the market price they paid at t_1 for the inputs and the market price they will have to pay at t_2 for those same inputs in order to restart production as a profit or loss due to the increase or decrease in the market price of those inputs between t_1 and t_2. For them there is a destruction or a creation of value. But from a societal point of view there is no destruction or creation of value but only a redistribution of value.

The approach submitted here is not only faithful to Marx's own method but also to reality itself. The alternative, neo-Ricardian, view is based on a mechanical extension to the inputs of what holds for the outputs. This mechanical application, in its turn, is the logical result of an approach based upon, and informed by, the notion of equilibrium in which simultaneous equations are used to calculate (production) prices. The assumption behind the use of simultaneous equations is that the price of a commodity as an input of a production process is determined *contemporaneously* with the price of the *same* (and any other) commodity as an output of the *same* (and any other) production process. This is patently absurd, that is it makes sense only in a timeless dimension. The consequence of accepting this approach is that, once the outputs are valued at their production price, the same must hold for the inputs as well. It is this equilibrium, timeless, and thus unrealistic framework which accounts for the theoretically empty notion of 'production price of the inputs'.[18] The assessment

of the inputs at their production prices, a notion of neo-Ricardian rather than Marxist matrix, has rooted itself so deeply in the literature that it has acquired the status of a self-evident truth. It is, nevertheless, mistaken.

1.5 FROM MONEY TO LABOUR QUANTITIES

We can now submit a method to compute the quantities of societal labour corresponding to the commodities' money prices. This possibility has repeatedly been questioned.[19] This section will show that these doubts are unfounded. Consider t_1–t_2. First of all, we know that

$$\mathrm{TLC}(t_2) = \mathrm{LT}(t_2) + \mathrm{NLC}(t_2) \qquad (1)$$

where $\mathrm{TLC}(t_2)$ is the total labour contained in the societal product, $\mathrm{LT}(t_2)$ is the labour transferred from the means of production to the product, and $\mathrm{NLC}(t_2)$ is the new labour contained in the product, all at t_2. Our strategy is to count $\mathrm{NLC}(t_2)$ first.

This problem can be solved. The hours of new labour contained can be empirically measured. These data could be collected through a special system of national accounting at the point of production. The difficulty here is not theoretical but practical, given that we have no such system at our disposal. But suppose we were given the means to set up such a system. This statistical office would collect data on the total *new* abstract labour expended during the time span t_1–t_2 by counting the hours of labour needed for the production of the different commodities.[20] But this office would not only count the hours of labour, it would also carry out a double reduction. The first is the reduction of more to less intensive labour. To this end, we need a minimum rate of intensity of labour. This can be empirically observed, for example by developing indices of fatigue. People working under these minimum conditions could count as contributing the hours of work actually worked. The hours worked at above minimum intensity would count proportionally as more hours. For example, in an hour of labour of minimum intensity so many calories are consumed. This hour would count as one unit of value while an hour of labour during which twice the average quantity of calories is consumed would count as two units of value.

The second is the reduction of skilled to unskilled labour. This reduction is needed because the new value created depends not only on the length of the working day and on the intensity of labour but also on the value of labour power. Thus, *ceteris paribus*, a skilled labourer produces more value than an unskilled one. The reason why skilled labour power has a higher value than unskilled labour power is that it costs society extra labour (training, education, and so on) to form skilled labourers (the minimum training, education, and so on which characterize unskilled labour power being socially and historically specific). Suppose that, in order to form a skilled labourer, it takes society twice the hours of labour than to form an unskilled labourer. Then, it is as if two unskilled labourers had been formed instead of one skilled labourer. It follows that, as far

as the costs needed to form skilled labour power are concerned, one unskilled labourer's labour power costs one half the costs needed to form a skilled labourer. The value of the former is half that of the latter and thus the former produces half the value produced by the latter. But how much more value does a skilled labourer produce than an unskilled one? The answer is not found in reduction coefficients computed on the basis of simultaneous equations.[21] Rather, *wages* are the reduction coefficients. To see this, consider Figure 7.2 again.

Sector A produces commodity *a* during t_0–t_1 and sector B produces commodity *b* during t_1–t_2 by using *a*. At t_1 *a* is bought by the producer of *b* for a certain money market price. Given that there is a quantitative correspondence between the quantity of money in circulation at t_1 and the value (that is society's labour) contained in (and realized through the sale of) the total output also at t_1, the money market price paid at t_1 for *a* (the inputs of *b*), corresponds to a certain value (a share of society's labour) and this is the value with which those outputs enter as inputs the t_1–t_2 period. This is the individual value of the inputs at t_1, which is quantitatively equal to the market price paid for them at t_1 as outputs of t_0–t_1. This *in aggregate* is also both the value transferred from the means of production to the product and the value (re)created by labour power during t_1–t_2.[22] If the market price of labour power at t_1 is also its individual value as an input of t_1–t_2, at the beginning of the period in question, t_1, so much societal labour has been adjudicated to that category of wage earners by paying them that wage level. Consequently, each hour of unskilled labour (paid the minimum wage) could count as one unit of value and each hour of skilled labour (paid a higher wage) would count as a proportionally higher quantity of units of value.[23]

This holds for categories of jobs, and thus for long term, moving, averages. Within each category it is always possible that some individuals might be paid more or less than the category's wage level. In this case, those individuals produce the same quantity of (new) value as if they were paid the average level, the only difference being that the value paid for, and the value of, labour power do not coincide any longer and that those individuals are subject to a different rate of surplus value.

Two objections could be raised against this approach. First, it could be objected that some category's wage might not reflect the societal labour actually needed to form that labour power. Rather, it might reflect more or less favourable power relations for that category or movements in the demand and supply of labour power at t_1. But this is immaterial for our purposes. Consider the period t_1–t_2. At t_1 it does not matter how the value with which that labour power enters t_1–t_2 has been formed. Any changes which affect categories of wages during t_0–t_1 affect the value of labour power entering t_1–t_2 because that is the social valuation of that labour power at t_1, irrespective of whether that evaluation is technologically, politically, or otherwise determined. It is the wage paid at t_1 which determines the value of labour power entering t_1–t_2.[24]

From this angle, wage differentials among categories of labourers reflect not only different levels of skill but also a number of other factors influencing the value paid for labour power at t_1, which is the value actually realized by labour power at t_1 and which at the same time also is the value at which that labour power enters the t_1–t_2 period. If society decides to pay that much for a category of labour power for whatever reasons, that is the value labour power has when it enters the production process. In other words, it is impossible, but also unnecessary, to separate the effects skill differentials on the one hand and other factors on the other hand have on the value of labour power, and thus on the wages paid for it at t_1. This hypothesis is consonant with the notion of the value of labour power being made up of two components, a physiological and a 'moral', that is socially determined one. The latter component, in its turn, is influenced by levels of skills as well as by other factors.

The second objection holds that the determination of the value of labour power by using wages as reduction coefficients implies circular reasoning. In fact, it is held, wages are determined according to the value of labour power but the value of labour power is determined according to the level of wages. The answer to this objection is not difficult to find. First of all, wages do not determine the value of labour power, they only measure it. Secondly, building upon our discussion of the transformation procedure, we know that we can take wages at t_1 as given. Then, labour power enters t_1 as an input with a value as measured by the level of wages. This value is what contributes to the creation of the value of the commodities at t_2, including wage goods. At t_2, the value of wage goods as outputs of t_1–t_2, in its turn, is what codetermines the value of labour power as an input of t_2–t_3. This latter is measured by the level of wages at t_2. The cycle begins anew.

Thus, the production of new value during one hour of labour is a variable which depends on both the value of labour power entering t_1–t_2, as indicated by the different average wages paid to the different categories of labourers performing different types of labour, and the intensity of labour during t_1–t_2, as observed by the special statistical system. By summing the results of both types of reduction (from above minimum to minimum intensity labour and from skilled to unskilled labour), we would know the hours of *new homogeneous* abstract labour contained in all the commodities produced in the time interval t_1–t_2. The new hours of labour contained in the products are thus arrived at through a socially determined evaluation of labour hours actually worked. Value is both qualitatively and quantitatively a socially determined concept. Qualitatively, because it is labour carried out under socially specific production relations. Quantitatively because the quantification of both the minimum skills and the minimum intensity as well as the deviations from these minima are socially determined quantities. New value (and thus also the dead labour transferred to the next period) is not simply new hours of labour: it is also their social valuation.[25]

Having measured $NLC(t_2)$, we can now proceed to estimate $TLC(t_2)$ as follows. Call $M(t_2)$ the total quantity of money in circulation[26] at t_2 and $MWP(t_2)$ money wages (of productive workers) and profits at t_2, that is the money representation of the new homogeneous labour added in the course of t_1–t_2. Then,

$$M(t_2) = \alpha(t_2)MWP(t_2) \quad (2)$$

where α is a proportion. Since in (2) both $M(t_2)$ and $MWP(t_2)$ are empirically known, $\alpha(t_2)$ can be derived.

The transformation procedure is based on the implicit assumption that all commodities are sold, that is that all value contained in them is also realized, so that the total value contained in the commodities produced during t_1–t_2 is equivalent to the total quantity of money in circulation at t_2. That is,

$$M(t_2) \equiv TLC(t_2) \quad (3)$$

Given (3), the proportion between total quantity of money in circulation on the one hand and money wages and salaries on the other, that is $\alpha(t_2)$ in (2) above, is equal to the proportion between total labour contained and new labour contained. Then,

$$TLC(t_2) = \alpha(t_2)NLC(t_2) \quad (4)$$

Since in (4) both $\alpha(t_2)$ and $NLC(t_2)$ are known, $TLC(t_2)$ is known too. We can now rewrite (3) as follows

$$M(t_2) \equiv \beta(t_2)TLC(t_2) \quad (5)$$

from which we obtain $\beta(t_2)$, the coefficient which gives us the number of homogeneous labour hours corresponding to a certain quantity of money, or the quantity of money expressing one hour of homogeneous labour at t_2. This means that *Marx's numerical examples can be interpreted both in terms of labour and in terms of money*. Let us then compute the labour contained in, actually realized by, and tendentially realized by, a commodity.

Take an output *b* at t_2 whose input, *a*, has been bought at t_1. Its market price is $MP_b(t_2)$ and the *labour actually realized* through the sale of *b* at t_2, or $LAR_b(t_2)$, is

$$LAR_b(t_2) = MP_b(t_2)/\beta(t_2) \quad (6)$$

If $LC_b(t_2)$ is the labour contained in *b*, $NLC_b(t_2)$ is the new labour contained in *b*, and $LT_b(t_2)$ is the labour transferred to *b* from *a*, all at t_2, then the *labour contained* in *b* at t_2 is

$$LC_b(t_2) = NLC_b(t_2) + LT_b(t_2) \quad (7)$$

$NLC_b(t_2)$ is known from the system of national accounts after the two above mentioned reductions have been carried out. $LT_b(t_2)$ can be computed by calculating the wear and tear of *a* in money terms (a task which could be carried out by the special system of national accounts) and by dividing it by $\beta(t_2)$. More specifically, suppose *a* lasts two periods, t_0–t_1 and t_1–t_2 and depreciates by 50 per cent in each period. It thus transfers 50 per cent of its value to the product during each period. In case of no technological change, at t_1 the coefficient $\beta(t_1)$ is

applied to the market price paid for *a* at t_0. At t_2 the coefficient $\beta(t_2)$ is also applied to the market price paid for *a* at t_0. But suppose that, because of technological competition, the price of *a* falls in the second period. Then the value transferred remains the same while the value realized falls.

Notice that we use the coefficient β at t_2 to assess the labour transferred, something which not only disposes of the 'backwards ad infinitum critique' but also makes the assessment of the value transferred dependent upon the social evaluation of the new labour performed during t_1–t_2 as well as upon the capital invested at t_1 (or at t_0 in case of unused capital stocks). What is important for the understanding of the system is not how much labour has been spent in the past centuries to produce these means of production, but their social valuation at the moment of assessment.

Finally, the *labour tendentially realized* by *b* at t_2, or $LTR_b(t_2)$ is given by dividing the price of production of *b* at t_2 in money terms, or $PP_b(t_2)$, as computed in section 4, page 14 by $\beta(t_2)$; that is,

$$LTR_b(t_2) = PP_b(t_2)/\beta(t_2) \qquad (8)$$

This is the unit price of production of *b* in labour terms. The practical difficulties met by actual computations of value in terms of labour would not be small. They would be compounded if we wanted to set up an international system of data collection (the only proper procedure). We need not elaborate on this point further because we are not arguing for the actual setting up of such a system. For us, it is sufficient to have shown that such computations are possible given that our aim is to discard definitely all notions of value which sever, either quantitatively or qualitatively, value from labour. *Value is labour*, abstract labour carried out under capitalist production relations and transforming, as concrete labour, existing use values into new use values. Money is the necessary manifestation of value but it is not value, unless it is commodity money.

If *unequal exchange* is defined as the appropriation of labour through the price forming mechanism, that is as the difference between the labour contained and the labour realized, then the unequal exchange inherent in the sale/purchase of *b* can be either the actual unequal exchange, that is the labour that has actually been realized through the sale of *b* less the labour contained in it, or the tendential unequal exchange, that is the labour which would tendentially be realized through the sale of *b* less the labour contained in it. The former is given by equation (6) minus equation (7) and the latter is given by equation (8) minus equation (7).

A consistent development of Marx's transformation procedure not only wards off groundless critiques but also, by corresponding to the real movement of production and distribution periods, makes of that procedure the centrepiece of a realistic depiction of price formation.

1.6 CONCLUSIONS

The method submitted in this chapter can be characterized as dialectical, chronological, dynamic and realistic. *Dialectical* because it analyses the transformation of individual values into actual social values and vice versa as well as, at each point in time, of actual social values into tendential ones. *Chronological* because it examines the succession of production and distribution processes. *Realistic* because it theorizes real social processes, that is because it abstracts from reality the elements it needs for its analysis rather than negating reality. It is because of its dialectical, chronological, and realistic nature that the present approach is *dynamic*. And it is because of this that this method is the antithesis of both the neo-Ricardian and the neoclassical methods. Two important consequences follow from the above.

First, it should be stressed that this method is based on real, or chronological, time rather than on 'logical time'. 'Logical time' is time without time, a self-annihilating proposition. This is the neo-Ricardian theoretical terrain which, unfortunately, has been taken over by those critics of neo-Ricardianism who subscribe to the 'iterative' approach. Logical time can be usefully employed in order to deliver an internal critique of neo-Ricardianism but is an obstacle to the development of a realistic picture of the process of price formation. Price formation should be understood as a chronological sequence of production and distribution periods. Reality is not, and therefore cannot be understood as, a computational approximation of market prices to an unchanged production price (the method followed by the iterative approach) but rather, as far as the tendential transformation is concerned, it is a real movement of market prices towards an ever changing average of themselves, the production prices. It follows that market prices emerge as already tending towards production prices. The transformation of 'values into prices', that is price formation, either reflects this real movement or becomes irrelevant to understand reality.[27]

Second, it has been mentioned that, under the conditions exemplified in Table 7.4, only the APCs tendentially realize the average rate of profit as well as the constant and variable capital actually invested. Higher or lower than APCs tendentially realize more or less than that average. Carchedi (1991, Chapter 3) shows that, while all APCs realize the average rate of profit, not all APCs also realize the surplus value they have actually produced. This is the case only for those APCs which also have an average organic composition of capital. This explains why Marx in *Capital* I breaks down the value of a commodity in constant capital plus variable capital plus the surplus value produced, or

$$V = C + V + S \qquad (1)$$

This is both the value contained and the value realized. In fact, this is a representative commodity and thus operates under average conditions of productivity. Moreover, as mentioned above, technological change is temporarily

disregarded. It follows from the discussion above that the value contained in the means of production at t_1 is exactly realized at t_2. The same holds for the new value created and corresponding to the value paid at t_1 for labour power. Finally, this capital, by operating under average conditions of productivity and of average organic composition, realizes exactly the surplus value actually produced. There is thus no difference between the value contained in, and the value realized by, that commodity. Relation (1) is usually seen as 'the' law of value operating in *Capital* I, supposedly modified, negated, and so on when Marx examines the formation of production prices in *Capital* III. But this is not the case. Relation (1) refers to the simplest case of a real process since Marx wants to disregard discrepancies between value contained and value realized in order to focus on the process of value transfer and production. This case, however, is the end result of a process of analysis of real price formation in *Capital* III which, for reasons of exposition, is presented as the starting point of the exposition of that analysis in *Capital* I.

To conclude, the interpretation submitted here goes further than vindicating Marx's method, the correctness of his transformation procedure, and the dynamism of the price theory of which that procedure is a centrepiece. It also rejects the equilibrium approach within which the great majority of Marx's commentators have framed the discussion. Equilibrium analysis is based on the hypothesis that individuals act rationally, that is that they aim to maximize their utility. But since any behaviour can be 'explained' by referring to utility maximization, this principle explains everything and nothing. All it says is that people do what they do because they want to do it (see further G. Carchedi, *Non-Equilibrium Market Prices* in this volume). In equilibrium analysis, the place where individuals express this rationality is the market and the result of each individual's utility maximization is the best possible allocation of people and means of production and thus a tendency towards equilibrium. But if the principle upon which the notion of equilibrium is theoretically empty, the same applies to the notion itself. And, in fact, a simple observation of reality shows that there is no reason to assume that the capitalist economy tends towards equilibrium, as recurrent economic and social crises show.

This means that the market loses not only its economic function of ensuring equilibrium; it also loses its social function of keeping the economy, and more generally, society together. It becomes then impossible to keep arguing that society is the summation of individual monads, each striving to maximize his or her own utility and kept together by a (non-existent) equilibrium. Society is kept together not by equilibrium but by social relations, by relations among people which reproduce themselves independently of which specific individual become carriers of those relations.[28] In the functioning and reproduction of these relations, that is of the social structure, the notion of equilibrium has no place whatsoever. It is only by throwing overboard this ideological constraint that we can hope to comprehend the dynamism of the process of price formation and of the

transformation process which lies at its heart. What economics most needs is to free itself from this most powerful, yet most deceiving, myth.

NOTES

[1] This chapter was developed from G. Carchedi and W. de Haan *From Reproduction Values to Production Prices*, Research Memorandum 9311, Faculty of Economics and Econometrics, University of Amsterdam, 1994.

[2] The terms individual value and social value refer respectively to the point in time before and after realization. In a different sense, they are both social, in that both of them are products of human labour performed under specific social relations of production.

[3] Even if they are tendential, production prices are real, in the sense that they represent a real movement. They are tendencies which do not realize themselves, unless by chance. This corresponds to one of the principles of dialectical analysis according to which reality is made up of both what has actually realized itself and what is potentially present (see Carchedi 1991, Appendix). The neo-Ricardian critique, however, ascribes to Marx the notion that both the production and the market prices are actually realized entities.

[4] In this paper the constant and variable capital are taken in percentage terms (unless differently stated) so that production prices are found by adding the average rate of profit to these percentage values.

[5] For example, in terms of Table 7.2, if sector A produces means of production, the value of the means of production bought by both sectors is 562.5 + 5000 + 437.5 + 659 + 6000 + 512 = 13171 while the value at which the same means of production are sold, after the equalisation of the rates of profit, is 1189 + 10568 + 925 = 12682. This quantitative discrepancy, the critics hold, is due to the fact that the same means of production appear as inputs at their not yet transformed value and as outputs at their transformed value.

[6] See also Giussani (1991), Kliman and McGlone (1988), Freeman (1984) and (1992a) and Ohno (1993 especially p169). For a review of the literature, see Carchedi (1991, Chapter 3).

[7] Thus, the individual value is the value contained in a commodity *before realization* through sale, *not* the unit value of a commodity after realization; that is, not the market price or the production price of a unit of output.

[8] Notice the terminology. Individual values are potential social values and social values are realized individual values. Social values are either actual social values (market prices) or tendential social values (production prices).

[9] This means that production prices are *not* equilibrium prices. See Carchedi in this volume.

[10] For a more detailed discussion of these issues see Carchedi (1991, Chapter 3, pp90-98). This paper should be seen as an improvement of sections 3.7.1 and 3.7.4.

[11] The classical statement of the infinite regression critique has been provided by J. Robinson (1977:365). Sraffa's attempt to escape infinite regression; that is, the reduction to dated quantities of labour (Sraffa 1960:34), is criticized in Carchedi (1991, Chapter 3). Here it is sufficient to mention that, even if Sraffa's method did find smaller and smaller physical residues; that is, greater and greater labour contents, of the means of production, these quantities would be the summation of the number of hours actually worked from the beginning of mankind to the present to produce the means of production of the period under consideration. This procedure disregards the issue of the heterogeneity of labour (see section 5 below). But, even more importantly, if it really counted, as Sraffa maintains, larger and larger quantities of labour, it would count quantities which are irrelevant to explain the way capitalism works. As we shall argue, for this purpose we need the reproduction prices of the inputs at the time the outputs (in which the inputs are incorporated) are sold.

[12] Notice that here we are merely assessing the logic of the infinite regression critique on the basis of the assumption that the inputs should be valued at their production price. The next section will argue that the evaluation of the inputs at their production prices is a wrong procedure. In computing the output's production price, the inputs should be valued at their *re*production price.

[13] Carchedi (1991:94, 97) refers both to production and to reproduction prices of inputs and thus is basically not free from this mistake.

[14] Marx refers to the mode; that is, to a situation in which the bulk of the products is produced by the modal capitals. It is also possible that no capital or no category of capitals is the modal one. In this case we should presuppose a different type of average, the mean. In this article we shall refer to the mode, but what said below applies equally well to the mean. See Carchedi (1991, Chapters 3 and 7).

[15] The fact that almost all participants in the 'transformation debate' theorize the transformation of 'values into prices' disregarding technological competition and thus different levels of technology within sectors, further obstructs understanding the dynamic nature of the transformation process and thus, as we shall see, theorizing the tendential value of the inputs as their tendential (reproduction) prices rather than as their production prices. The absence of technological change is almost universally believed to be a feature of Marxian production prices while, as Naples (1993) stresses, it is a feature of neo-Ricardian models. Table 7.2 can be reduced to an example in which sector A invests $62.5_C + 37.5_V$ and sector B invests $73.2_C + 26.8_V$. These are two representative capitals investing one unit of capital each. But this depicts the tendential point towards which technological competition pushes the different capitals rather than portraying a situation without technological competition.

[16] The fact that for Marx the market value implies higher and lower than average rates of profit for above and below APCs (contrary to Table 7.3) indicates that Marx considers price forming; that is, the formation of market values, under the hypothesis of the actual, rather than of the tendential, technological structure (as in Table 7.3). The case referred to by Marx can be exemplified as follows

	(1)	(2)	(3)	(4)	(5)	(6)
A_I	900	1200	90	1539	639	71%
A_{II}	8000	11000	640	10944	2944	39%
A_{III}	700	1000	42	718	18	2%
Total A		**13200**	**772a**	**13200**		
B_I	900	1100	135	1691	791	88%
B_{II}	8200	10400	820	10270	2070	25%
B_{III}	700	900	35	439	–261	–37%
Total B		**12400**	**990b**	**12400**		

where column 1 gives the capital actually invested, column 2 the value actually produced, column 3 the actual output, column 4 the value tendentially realized, column 5 the surplus value tendentially realized, and column 6 the tendential rates of profit. Columns 1, 2, and 3 are the same as in Table 7.1. Column 4 is derived by first computing the unit market values. That is, if MV_a and MV_b are the two unit market values, $MV_a = 13200/772a = 17.1$ and $MV_b = 12400/990b = 12.525$. Then Column 4 is derived by multiplying MV_a and MV_b by the figures in column 3. Column 5 is derived by subtracting column 1 from column 4 and column 6 is derived by dividing column 5 by column 1.

[17] The total of column 6 in Table 7.4 (that is, 25798) is more than the total of column 2; that is, 25600. Or, the value tendentially realized is different from the value actually produced. This is impossible, given that redistribution neither creates nor destroys value. Then, either we assume that the necessary value can come from other sectors of the economy or not. In the latter case, all prices will have to fall. In case they fall proportionally, we apply a distributional ratio = 25600/25798 = 0.9923. By applying this ratio to all figures in column 6 of Table 4, we obtain the total of 25600. See Carchedi (1991, Chapter 3) for further details.

The economic reality behind the application of the distributional ratio is the fact that the production price depends not only on the structure of production but also on the structure of demand. In fact, for all the rates of profit to be equalised, the structure of demand must be such that (1) all commodities are sold (2) at a price at which all APCs realize the average rate of profit. If demand, that is purchasing power, is insufficient, the APCs do realize the average rate of profit, only a lower one.

The production price is the socially necessary labour time. The notion that this latter depends also on the structure of demand is contrary to the commonly held opinion (see, for example, Meek 1973:179) that the socially necessary labour time depends only on the structure of production, and to what Indart seems to submit (1990:732); that is, that the socially necessary labour time depends on demand only in case technological competition within branches is disregarded.

[18] This is in line with the following somewhat convoluted passage: 'As the price of production of a commodity can diverge from its value, so the cost price of a commodity, in which the price of production of other commodities is involved, can also stand above or below the portion of its total value that is formed by the value of the means of production going into it' (Marx 1981:265). In other

words, given that *a*'s price of production may differ from its individual value, the possibility exists that *a* might enter *b*'s production process and thus production price at its (that is, *a*'s) production price rather than at its individual value. Then, clearly, the cost price of *b* can be higher or lower than the individual value of *a*. This quotation has been taken out of context.

Marx is not arguing for the assessment of the means of production at their *production price as inputs of the present period*. Rather, Marx wants to point out that the difference between *a*'s individual value, before sale at t_1, and production price (after sale) is 'immaterial' for the point he wants to make; that is, that as far as *this* period is concerned, 'the cost price of a commodity refers only to the quantity of paid labour contained in it, while its value refers to all paid and unpaid labour contained in it' (Marx 1981:265).

Even authors radically breaking with the equilibrium approach, such as Kliman and McGlone (1988), with whom we are in general agreement, submit numerical examples in which production prices are computed on the production prices of the inputs. However, they do not see these examples as attempts at describing a real movement of price formation. See the stimulating discussion with Naples (1993) and Kliman (1993).

[19] See, for example, 'political economy failed to produce a convincing demonstration that the value of commodities could be measured in terms of socially necessary labour time' (Holton 1992:114-115).

[20] The objection that one can only count hours of concrete labour simply does not hold. The fact that hours of labour spent performing different types of concrete labour can be *quantitatively compared* shows that it is abstract labour that is counted.

[21] For the original critique, see Böhm-Bawerk (1984). For a sample of 'solutions' along these lines, see Roncaglia (1974) and Rowthorn (1974a). See also Itoh (1987) and Devine (1989). Lack of space prevents us from comparing our approach to that of these authors.

[22] This view, by the way, accounts for the reason why skilled labourers are paid higher wages years after those skills have been acquired. This is not to be sought in the higher costs to society in the past. Rather, the reason must be sought in the present reproduction prices of skilled labour power.

[23] Cases of individual labourers whose superior skills are due to innate abilities, rather than to extra training and the like, are an example of how natural differences are translated, under capitalism, into social inequality. This case is similar to that of the forces of nature which when 'appropriated to productive processes … cost nothing' (Marx 1976a:508) to, and 'perform gratuitous service' (*ibid*:510) for, capital. Innate abilities too do their work gratuitously for capitalist society. In both cases the individual capitals produce more use values and thus *appropriate* more exchange value. Compare this approach to that of Meek (1973:173) for whom, in case of industries employing higher than average proportions of labourers with innate higher abilities, the labour theory could be applied 'only *at the margin*'.

[24] Under the assumption that at t_1 all value produced is realized, if at t_1 a higher (lower) value is paid for means of production and this is compensated by a contrary movement in the value paid for some other means of production, the total value transferred during t_1–t_2 does not change. Likewise for compensating movements in the value paid for categories of labour power: total new value produced during t_1–t_2 remains the same. However, a higher (lower) value paid for some means of production and compensated by a lower (higher) value paid for labour power does affect the new value produced during t_1–t_2. Thus, in this latter case, distribution at t_1 does not affect the value produced during t_0–t_1 but it does affect the total value produced during t_1–t_2 and realized at t_2. Similarly, distribution at t_2 does not affect the total value produced during t_1–t_2 and realized at t_2. Rather, it affects the total value produced during t_2–t_3 and realized at t_3. That the value of labour power is determined by factors other than the level of skills is consonant with the notion of actual (as opposed to tendential) socially necessary labour time. As seen above, this is determined both by technological factors and by the discrepancies between demand and supply (showing too little or too much time has been spent on a commodity). Instead of present wages, an average of past values could be used to offset incidental wage movements.

[25] This approach differs both from neo-Ricardianism, where no social weight is applied to labour hours, and from the 'value form' approach which severs all links between value and labour thus reducing value simply to its social manifestation, money.

[26] Even though our analysis can accommodate both commodity money and non-convertible paper money, we assume the latter. We also disregard the velocity of money.

[27] The expression 'market prices fluctuate around production prices' or 'market prices tend towards production prices' could be interpreted as if market prices fluctuated around, or tended towards, pre-existing production prices. But this is not what is meant here. As soon as they emerge, market prices are pushed towards production prices by technological competition and capital movements. Thus, logically, market prices exist before production prices. The latter exist only because and inasmuch as market prices tend towards an average of themselves. Chronologically both categories of prices exist contemporaneously.

[28] This is discussed in Carchedi, G. *Determination, Individuality, and Structure in Marx*, unpublished paper.