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## **Political economy and capitalism: notes on Dobb's theory of crisis**

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### **1. Introduction**

I began the formal study of economics in the late 1960s, when the cry for 'relevance' was sweeping the US. Though at the time we were frequently unclear about just what our demand for 'relevance' implied, we were certain of one thing: it did not imply any further meditation on the arcane mysteries of perfect competition, perfect knowledge and perfect greed.

Not surprisingly, many of us turned elsewhere to acquire the knowledge which was so conspicuously absent from our education. And as we did so, we came to realise that 'relevance' meant much more than just focusing on the concrete history and existence of our world: it meant having a practice which made such a study necessary, and a theoretical structure which made its results intelligible. Maurice Dobb had such a practice and theory—Marxism—and he illuminated it with a guiding intelligence which makes his work 'relevant' in the precise sense of the word: it continues to be important to our understanding of the conditions in which we live.

In these few pages, it is obviously impossible to do justice to the scope and depth of Dobb's contribution to Marxist economic theory. I do not intend even to try. Instead, what I would like to do is to try to focus on one particularly important work of his, *Political Economy and Capitalism*.

On re-reading this book, which was written in 1937, I was especially struck by the timeliness of Dobb's discussion of the contradictions in capitalist accumulation. The current crisis in world capitalism has made crisis theory respectable once again, thus giving rise to a fresh round of debates on many of the very same issues which Dobb analysed almost 40 years ago. Of course, to a certain extent Maurice Dobb's contributions are already incorporated into the current discussions; nonetheless, there are still many lessons to be learned from this book alone.

One of the most important points Dobb makes in his analysis of crises is to emphasise that, within Marxist analysis, a crisis is not to be viewed as a departure from equilibrium; instead, a crisis *is* the equilibrating mechanism itself. It 'appears as catharsis as well as retribution: as the sole mechanism by which, in [the capitalist system], equilibrium can be enforced' (Dobb, 1937, pp. 102–103); to 'study crises [is] *ipso facto* to study the dynamics of the system', for they are its 'dominant form of movement' (p. 80). This is a crucial point to make, for otherwise Marxist analysis is saddled with a notion of 'equilibrium' which is imported wholesale from orthodox economics. Marx's own

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analysis is posed not in terms of equilibrium *positions*, but rather in terms of 'regulating' *movements*, of which he in fact posits two distinct types. First of all, there is the manner in which the market prices of individual commodities are regulated by their prices of production, in which supply and demand constantly chase each other as capitalist competition reduces differing market rates of profit to the average rate: 'the average periods during which the fluctuations of market prices compensate each other are different for different kinds of commodities', Marx points out, 'because with one kind it is easier to adapt supply to demand than with the other' (Marx, 1968, p. 208). These movements, it will be noted, imply a process of regulation through *constant disequilibrium*, in which prices of production act as centres of gravity of market prices.†

The second type of regulating movement which Marx discusses has to do with capital as a whole. Here, the issue is not merely the proportional relations between individual capitals but rather the rhythm of the overall accumulation process itself: 'capitalist production moves through certain periodical cycles, . . . through a state of quiescence, growing animation, prosperity, overtrade, crisis, and stagnation' (Marx, 1968, p. 223). Capitalist credit relations, Marx argues, are the key to this movement, because through the extension of credit capitalists can begin production and continue to expand it without having to wait for the sale of their products: an ever lengthening chain of credit relations is therefore characteristic of the period of recovery and prosperity, while a contracting and even collapsing chain is characteristic of the period of crisis and stagnation (see Marx, 1967, vol. III, p. 254).

From the above point of view, capitalist accumulation appears as a process in which the anarchy of private production faces up to the requirements of social reproduction through cycles and/or crises. It is 'precisely because capitalist production is production for profit', Dobb goes on to argue, that '“overproduction of capital” becomes possible in the sense of a volume of capital accumulation which is inconsistent with the maintenance of the former level of profit' (p. 116). Thus the system comes to a standstill not because too much wealth is produced in relation to the satisfaction of social needs, but because the existing level of production is incompatible with capitalist criteria for continued production. Of course, the association of a fall in profitability with a crisis does not necessarily imply any particular cause for the crisis. In general, the outbreak of a crisis, of a rupture in the circuits of capital, will result in masses of commodities being either sold off at abnormally low prices or not sold at all—thus giving rise to generally lowered profits. Associated with a crisis, therefore, will be a fall in profitability. This type of fall, however, is merely a consequence of the crisis itself, and would be present no matter what the cause. We turn therefore to the question of the causes themselves.

In his discussion of crises, Dobb examines and criticises a variety of explanations of the causes of crises, ranging from underconsumption and disproportionality theories to Marx's controversial notion of the 'tendency of the rate of profit to fall'. In this paper, I concentrate on the latter alone, for three reasons: first, because Marx presents it as a major 'law' of capitalist development, so that a discussion of its derivation and status is of obvious importance to Marxist analysis; second, because recent debates have made some progress in clarifying the issues involved; and third, because I believe that Dobb makes major and influential errors in his derivation of this 'law', errors

† In a recent paper John Eatwell (1977) traces the processes of transition from the classical notion of 'centres of gravity' to the neoclassical notion of the 'long run'. A similar study of Marx versus the classicals and the neoclassicals waits to be done.

which have important consequences for his (and subsequent) conclusions about its significance (for an analysis and critique of crisis theories in general, see Shaikh, 1978).

## 2. Dobb on the falling rate of profit

We begin by analysing the movements of the (labour) value categories involved in the rate of profit, for it is in these terms that the tendency of the rate of profit is posited. At a later stage, the implications of this analysis will be extended to the money rate of profit, which in general will differ in magnitude from the value rate when prices of production rule. It is, however, beyond the scope of this paper to examine actual crisis scenarios.

In general, the annual value rate of profit may be written as

$$\rho = \frac{s}{C+V} \quad (1)$$

where  $s$  is the flow of surplus-value produced over a year,  $C$  the value of the stock of constant capital (machines, buildings, raw materials, etc.) required to carry a year's production, and  $V$  the value of the corresponding stock of variable capital ('wage fund' of productive workers). Since the stock of variable capital  $V$  is related to the flow of variable capital  $v$ ,  $V = v/n$ , where  $n$  is the annual number of turnovers of variable capital, we can follow Marx (1967, vol. III, p. 50; the exact formula is due to Engels) in writing the value rate of profit as

$$\rho = \frac{s/V}{(C+V)/V} = \frac{(s/v)n}{(C/V)+1}. \quad (2)$$

The rate of profit is thus decomposed into three terms:  $(s/v)$ , the annual rate of surplus-value;  $n$ , the annual number of turnovers of variable capital; and  $C/V$ , the value composition of capital. Of these, it is the interaction of  $s/v$  and  $C/V$  which is crucial for the falling rate of profit issue, for the influence of turnover time operates within strict limits.†

Dobb begins by arguing that in general, as accumulation proceeds at a constant organic composition, the growing demand for labour will eventually deplete the reserve army, wages will begin to rise, and the rate of profit will begin to fall. Hence capitalists will substitute machines for workers: 'the normal accompaniment of capital accumulation was [therefore] a rise in the organic composition of capital; and this change, unless it were offset by an increase in the "annual rate of surplus value", would precipitate a fall in the rate of profit' (p. 108). Since all of this depends on whether or not real wages rise as accumulation proceeds, Dobb further posits two distinct cases: first, one in which for a variety of reasons the reserve army is very large (because of rapid population growth, rapid mechanisation, and/or a growing pool of dispossessed and proletarianised peasants and small-producers), so that real wages do not rise with accumulation (pp. 110–113); and second, one in which the reserve army is small (wage labour more or less general, and workers organised), so that as accumulation shrinks the labour-reserve, wages do indeed rise. According to Dobb, only in the latter case will the organic composition rise, and the rate of profit fall (pp. 113–114).

† The limited influence of variations in turnover time, which cannot, for reasons of space, be treated here, will be demonstrated in a forthcoming note.

As a presentation of Marx, this presents several problems. First of all, since for Dobb the former case corresponds to the 'golden age of competitive capitalism' (p. 123), and the latter to the period of monopoly capitalism [after the 'fourth quarter of the nineteenth century' (p. 124)], he in effect ends up by arguing that the tendency of the rate of profit to fall is *not* meant to apply to the period from which Marx derives it, and that it *is* meant to apply to the modern period! This is a rather striking inversion.

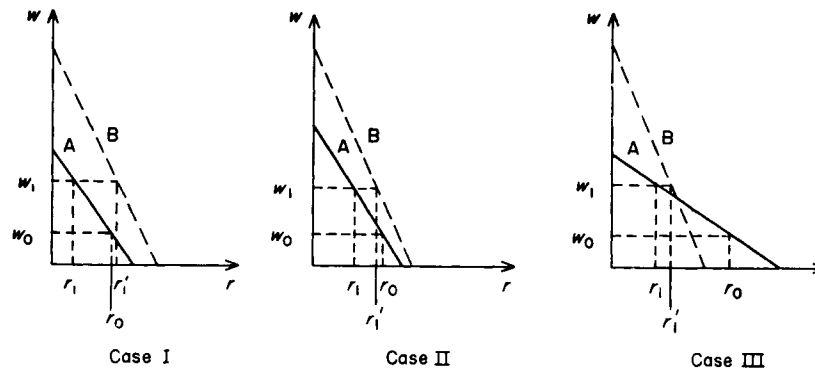
The second problem is related to the first. Dobb's description of the 'falling tendency' is the following: a rise in the real wage under given conditions of production (technology, length and intensity of working day, etc.) leads to a fall in the rate of surplus value, and hence to a fall in the rate of profit. This in turn induces capitalists to seek out or create more efficient and 'labour-saving' techniques: when these techniques are in general use, on the one hand their greater efficiency will imply a higher rate of surplus value, while on the other hand, their 'labour-saving' character will generally imply a higher organic composition. In order for the rate of profit to *rise*, it is necessary for the new technique to raise the rate of surplus value sufficiently to compensate not only for the effect of the higher real wage, but also for the rise in  $C/V$  which accompanies it. If this does not happen, a rise in the organic composition will indeed be *associated* with a fall in the rate of profit, *but only because both of them will have been caused by a rising real wage.*† In Dobb's presentation, therefore, the rising organic composition is a consequence of a falling rate of profit! This is an even more striking inversion than the first one.

It is interesting to note that Dobb's later views are not significantly different from this, his 1937 position. Writing in 1973, he begins with the standard presentation: Marx showed that 'labour-saving' technical progress would result in a rising organic composition, which in turn would lower the rate of profit consistent with a *given* rate of surplus-value. But, says Dobb, technical progress can be 'capital-saving' as well as

† Consider this movement in the simple case of a linear wage-profit curve. Let A be the existing technique, and B be the new labour-saving technique with a higher organic composition (higher slope).

As accumulation proceeds, real wages rise from  $w_0$  to  $w_1$ , which results in a fall in the rate of profit from  $r_0$  to  $r_1$ . Now the new technique is invented. For it to be 'chosen' at the current real wage  $w_1$  it must yield a rate of profit  $r_1'$  which is higher than the current rate  $r_1$ .

These three cases are possible:



In all cases, the new technique raises the rate of profit consistent with the current wage  $w_1$ , so that  $r$  rises from  $r_1$  to  $r_1'$  when the new technique is adapted. In Case I, this new rate of profit is *also* higher than the initial rate of profit  $r_0$ , so that in this case, although real wages have risen from  $w_0$  to  $w_1$ , the rate of profit has also risen (overall) from  $r_0$  to  $r_1'$ . In the other two cases, however,  $r_1' < r_0$ , so that the rise in real wages is accompanied by an overall fall in the rate of profit from  $r_0$  to  $r_1'$ .

'labour-saving', a point which Marx seems to have missed. In addition, since technical progress of any kind must cheapen commodities, it must raise the rate of surplus value consistent with a given real wage, and by cheapening constant capital ( $C$ ) it must retard or perhaps even offset the tendency of 'labour-saving' technical progress to raise the organic composition ( $C/V$ ). Marx does not seem to have said much about the relative strength of these offsetting factors, Dobb asserts, probably because like other 19th-century economists he just 'assumed' that the actual rate of profit was falling.† In the end Dobb reverts to his own earlier explanation, in which rising wages lower the rate of profit. Marx himself, he claims, in a chapter entitled 'The General Law of Capitalist Accumulation', cites rising wages during the boom as a cause of falling profits and hence the cause of the eventual bust.‡

### 3. Mechanisation

#### (i) Marx on mechanisation

In Marx's discussions of these matters, it is clear that he presents a rising organic composition as a cause of a falling rate of profit, rather than as an effect of an already falling rate occasioned by rising wages. It is quite important, therefore, to trace the manner in which Marx attempts this connection. I should immediately say at this point that within the confines of this paper it is only possible to outline briefly what I believe to be the essential determinants of the problem.

First of all, in Volume I of *Capital* Marx argues that under capitalism, after a certain historical point, automation becomes the dominant form of the development of the social productivity of labour. Capitalists purchase labour-power for a specified period, and at all times their *raison d'être* is to squeeze the maximum possible productivity out of it during the labour-process. This entails extending the length of the working day

† Rosdolsky (1977) traces the structure of Marx's argument on the issues of the law itself versus counter-acting influences and in so doing implicitly provides a fundamental critique of Dobb's version of the matter.

‡ Dobb (1973) pp. 157–158. It is interesting that in the end Dobb cites Marx's analysis in ch. 25, § 1 of *Capital*, vol. I, as a 'wage-squeeze' model of crisis. This is in spite of the fact that in Marx this section is used only to argue that even under the best hypothetical circumstances (from the point of view of the employment of workers), there exist strict limits to the gains in real wages which can be achieved. Thus if the organic composition is constant, the demand for labour will grow in the same proportion as capital grows, so that eventually the reserve army will be exhausted, and wages will begin to rise as accumulation proceeds—until 'at some point' they will interfere with accumulation itself. At this point accumulation will slow down or even halt and thus the stimulus to rising wages will be blunted or disappear altogether.

In this section, and indeed in Vol. I altogether, Marx does not say how to determine the point at which accumulation will halt (though it is clear that it cannot merely be the point at which there is a fall in the rate of profit, because under given conditions of production any rise in real wages would lower the rate of profit).

Instead, he goes on to point out that in any case accumulation does *not* proceed at a constant  $C/V$  but rather at a rising one. From this he derives his first great law of capitalist accumulation, namely the tendency for capital to create surplus-population.

Not till Vol. II does Marx even define the concept of the *rate* of profit, and not till Vol. III does he address the other great consequence of a rising  $C/V$ , namely the tendency of the rate of profit to fall. *It is only at this point that he has at hand the concepts necessary to address the question of the 'point' at which accumulation halts.* This point, at which what he calls 'absolute over-production of capital' occurs, is when the fall in the rate of profit has led to a stagnation in the mass of surplus value. Normally accumulation increases the mass of surplus value; but if the fall in the rate of profit offsets the expansion in the stock of capital advanced to such an extent that the mass of surplus value does not grow, it means that the increment  $\Delta K$  in capital has not produced any increment in profit (surplus value). A sharp competitive struggle among capitalists will break out, and as the weaker capitalists fail the crisis will spread (Marx, 1967, vol. III, ch. XV, pp. 251–255).

and the intensity of labour, within given methods of production, and/or modifying the labour process itself. The former method, Marx notes, is ultimately limited by the physical endurance of workers, and limited at any moment of time by their opposition. Consequently, as the growing strength of the working class comes to be expressed in social legislation such as the Ten Hour Working Day, abolition of child labour, etc., capital is increasingly forced to raise the productivity of labour by modifying the labour process itself. This takes the form of 'perfecting' the labour process from the point of view of capital, through its routinisation, its subdivision into ever-increasing detail operations, and the assignment of each such subdivision to different workers on a *permanent* basis. Thus capitalists continually attempt to reduce the existing activities of living labour to *mechanical forms*. And it is this prior reduction which in fact makes it possible to replace some human functions, now automaton-like functions, by actual automatons: machinery now takes the place of some workers.

It is important to realise that Marx presents this movement as being immanent in the capitalist labour-process itself: he derives not only the historical genesis of modern 'machino-facture' from this, but also its continuing transformation to ever more mechanised levels. Any given level of mechanisation presents the capitalist with the same problem all over again: the machine represents the ideal worker; the actual worker merely an imperfect machine.†

It follows from this that the basic drive towards automation arises independently of movements in real wages: out of the very fact that capital controls the labour process. It is for this reason that Marx can derive not only the transformation of manufacture by modern machinery but also the continued growth of mechanisation of the labour process, *during* the 'golden age of competitive capitalism' for which Dobb is forced to argue that the organic composition will not rise.

The above discussion locates the first error in Dobb's presentation of Marx. The tendency towards substitution of machinery for living labour, which Dobb sees as merely one of many equally likely outcomes, is according to Marx an absolutely necessary outcome of the capitalist-controlled labour-process. This is not to say that rising real wages or rising prices of some inputs may not induce technical changes which seek to offset these factors, nor that other forms of technical change will not occur.‡ What it does say is that automation is both intrinsic to capitalism and is its dominant form of technical change. It is the technological expression of the social relations of production under capitalism.

Increasing mechanisation gives rise to what Marx calls a rising technical composition of capital: an ever greater mass of use-values in the form of machines and material inputs is required to employ a given mass of labour-power. Since every capitalist is subject to this necessity, which competition only intensifies, Marx treats this as a general process, not confined to any one sphere of production (Marx, 1967, vol III, p. 212). One effect of mechanisation (indeed of any technical progress) is to lower the unit values of commodities, so that both the value of a *given* mass of means of production

† Marx's treatment of the capitalist development of the labour-process is traced in Rosdolsky (1977), chs. 15–18. Braverman (1974) traces the development of the labour-process since Marx's time, and strikingly confirms the process of division–subdivision–detail labour–automation as being immanent in capitalist production.

‡ It should be noted that from the point of view of a catalogue of all possible cost-reducing innovations, mechanisation is no more likely than 'machine-saving' or 'material-saving' technical change. But technical progress does not fall (randomly) from the sky. It is a socially purposive process in which the development of machinery becomes the primary means of cost reduction.

and of a given mass of labour-power (whose value is the value of its means of subsistence) will fall. The question is, what are the overall effects of mechanisation on the organic composition of capital and on the rate of profit? The first part of the question is discussed in Appendix 2; the next section deals with the effect on the rate of profit.

(ii) *Mechanisation and the rate of profit*

In Volume I of *Capital* Marx develops the connection between mechanisation and a rising organic composition of capital, from which he derives the general law of the 'progressive production of a relative surplus-population or industrial reserve army' (see Appendix 2). This is the aspect of mechanisation which most directly bears upon the working class.

But in Volume III Marx shows us the other side of this coin. Here, and earlier in the *Grundrisse*, he argues that mechanisation also gives rise to the law of the tendency of the rate of profit to fall, a law which he claims, 'is in every respect the most important law of modern political economy . . . [and] is from the historical standpoint the most important law' (Marx, 1973, p. 748). This is the other aspect of mechanisation, the aspect which most directly bears upon capital itself.

Because the falling rate of profit has been much discussed lately (see, for example, Olin-Wright, 1977; Hodgson, 1974; Itoh, 1975) and because its development in Marx is so excellently traced by Rosdolsky (1977; ch. 26 and appendix to Part 5), we can be brief here. Returning to the formula for the value rate of profit in equation (1), it is easy to show that the rate of profit has an upper bound  $\rho_m$ . Let  $h$  = the length of the working day; then  $l = Nht$  = the flow of labour-time worked by  $N$  workers over the year ( $t$  working days); by definition the surplus labour-time  $s$  equals the total labour-time minus that portion of it which is necessary to reproduce the labour-power involved. Thus  $s = l - v$ , and since the stock of variable capital  $V = v/n$ , we may write:

$$\rho = \frac{s}{C+V} = \frac{l-v}{C+v/n} < \rho_m = l/C. \quad (3)$$

The upper bound  $\rho_m$  is independent of any division of the working time into necessary and surplus labour-time, and hence independent of the rate of surplus-value  $s/v$ .<sup>†</sup> It is what Marx calls the ratio of living to dead labour.<sup>‡</sup> The question is, how is this connected to mechanisation.

Marx makes the connection in the following manner. Mechanisation as such, he notes, means raising the productivity of labour *through* the extended employment of machinery. The resulting increase in productivity means that workers can now transform greater quantities of products. Thus each worker sets in motion a more extensive mechanical apparatus with which a greater quantity of materials is processed into a correspondingly greater quantity of product.

In a recent article, Bertram Schefold (1976A) provides a proof of the following result. Using a Sraffa system involving fixed capital, he proves that mechanisation, defined as increased inputs of machinery per unit output, combined with the same or increased quantities of materials and a reduced amount of labour, necessarily lowers the maximum

<sup>†</sup> The upper bound  $\rho_m = l/C$  is not independent of the rate of turnover  $n$ , since  $C =$  stock of fixed + stock of circulating constant capital  $= C_f + c_m/n$ , where  $c_m =$  flow of circulating constant capital. However in the limit  $n \rightarrow \infty$  (turnover time approaches zero),  $\rho_m \rightarrow \rho_m' = l/C_f$ . Thus  $\rho > \rho_m > \rho_m'$ , where  $\rho_m$  is independent of turnover time.

<sup>‡</sup> Since  $C$  is the labour value of the stock of means of production, and  $l$  the flow of labour value added by workers, the price equivalent of  $C/l$  is the current dollar capital/net output ratio.

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rate of profit,  $R$ . Note that if mechanisation were to raise output per worker to such an extent that inputs of machines per unit of output fell, this result would not hold. Marx did not regard this to be typically the case, arguing that, in general, increased output could only be purchased 'at a cost'. Thus the gain in productivity is purchased through an increase in 'roundaboutness' and  $R$  falls with the rise in  $C/l$ .†

The proposition that mechanisation, so defined, lowers the maximum rate of profit would appear to imply that *sooner or later* the actual rate of profit must necessarily fall. And indeed this is exactly how it has been interpreted by many Marxists. The basic logic of Marx's argument, therefore, seems to emerge unscathed.

But the debate does not end there. In recent years, another line of opposition has developed. Here, it is argued that precisely under the conditions analysed by Marx, in which mechanisation occurs independently of any change in the real wage, the criteria by means of which capitalists adopt new methods of production will exclude any fall in the actual rate of profit. Thus technical progress will necessarily raise the rate of profit corresponding to a given real wage only if real wages rise so much that technical progress cannot offset their effects on the rate of profit—only then will the rate of profit fall.

If the above is true, it follows that even though Dobb did not adequately represent Marx's own arguments on the laws of mechanisation and the rate of profit, he nonetheless displayed sound instinct in reformulating at least the latter law so as to give primacy to movements in the real wage. This is the issue we turn to next.

#### 4. The 'choice of technique' under capitalism

In the preceding section, I have tried to outline the structure of Marx's argument that under capitalism the dominant form of technical change necessarily involves the substitution of machines for workers, and to trace the connection which exists between this argument and the tendency of the rate of profit to fall.

But the analysis of the general nature of technical change is only half of the story. It is also necessary to analyse how this process manifests itself in competition—in other words, how it appears to the individual capitalists. To do this, we must first briefly discuss Marx's notion of the 'competition of capitals'.

##### (i) *Marx on competition*

By competition, Marx means the 'action of the many capitals upon one another' (Marx–Engels, 1975, p. 97). It is through this action and interaction of individual capitals that the basic laws of capitalist accumulation are executed; competition does not explain these laws, nor produce them, but rather lets them become visible (albeit in inverted form, for circulation is the mirror of production) (Marx, 1973, p. 776).

But competition is not a game. It is a war, in which the big devour the small, and the strong happily crush the weak. The laws which competition executes in turn frequently execute many of the competitors.‡ And the principal weapon of this warfare

† The maximum rate of profit Schefold refers to is the maximum money rate of profit, which will in general differ from the maximum value rate of profit  $\rho_m = l/C$ , wherever the organic compositions are unequal. However, he also proves that the capital–output ratio for a given rate of profit is higher in the more mechanised technique. Since the capital–output ratio for a zero rate of profit is  $l/C$ , he thereby proves Marx's proposition that  $l/C$  is higher for the more mechanised technique.

‡ The concept of competition as an ongoing struggle for survival is fundamentally different from the neoclassical conception of individual capitals as perfectly competitive price takers, which are assumed to have no direct effect on each others' market shares or profitability.



is the reduction of production costs, for every such reduction enables a capitalist to lower his prices and drive his competitors out of the field without simultaneously ruining himself. 'The battle of competition is fought by the cheapening of commodities' (Marx, 1967, vol. I, p. 626).

Taken by itself, however, all that competition establishes is the necessity 'for the reduction of production costs'; from this perspective all types of technical change are equally feasible (a point which orthodox economics, rooted as it is in circulation, always presents with an air of triumph). It is for this reason that Marx derives the dominance of mechanisation from the relations of production, 'out of the relation of capital to living labour, without reference to other capitals' (i.e. to competition) (Marx, 1973, p. 774).

Therefore, with respect to mechanisation as such, the role of competition is a very specific one: it acts as a 'filter', weeding out any potential techniques which do not reduce costs. And so the question naturally arises, what is the scope and effect of this filtering process?

(ii) *The Okishio theorem*

In an article written in 1961, Nobuo Okishio sets out to investigate this (and other) questions. Having formulated the algebraic relationship between a rising  $C/l$  and a falling maximum rate of profit  $R$ , Okishio notes that if  $C/l$  is indeed rising, it seems clear that the actual rate of profit must sooner or later fall (Okishio, 1961, p. 80). But, he argues, this appearance is misleading *because competition will filter out all processes which tend to lower the rate of profit consistent with a given real wage*.

Consider given technical conditions in each industry, with a given real wage and concomitant rate of profit and prices of production. Now suppose capitalists in some industry 'cost up' an alternative method of production (using the ruling input prices and real wage), and find this method to have a lower unit cost of production (unit cost-price in money terms). What Okishio proves is that if this new, cheaper, method of production is actually adopted and new prices of production arise, the average rate of profit in the economy as a whole will either be unchanged (if the industry produces luxury goods) or it will rise (if the industry produces means of production or means of subsistence). In any event, the average rate of profit corresponding to a given real wage cannot fall.†

Since this result is well established by now, it is not necessary to prove it here. We can, however, state it in the following way. Let the  $j$ th ruling price of production be designated by  $p_j$ , the ruling real wage by  $w$ . Then, at these ruling prices, let  $k_j$  be the unit cost-price (depreciation and material costs per unit output, plus wage costs per unit output) in money terms, of the ruling technique in the  $j$ th industry. It follows that

$$\pi_j \equiv p_j - k_j = \text{money profits per unit, in the } j\text{th industry} \quad (4)$$

and, as defined by Okishio.‡

$$m_j \equiv \pi_j / k_j = \text{money rate of profit in the } j\text{th industry.} \quad (5)$$

† It should be noted that this result does not depend on the deviations of prices of production from prices proportional to values. Whether organic compositions of capital are equal or not, Okishio's result holds. A somewhat different proof of the same point is presented by Himmelweit (1974). She then elaborates the argument that only a sufficient rise in real wages could lower the rate of profit, and ends up by explicitly deriving the 'reversals' in Dobb's analysis to which I have referred above.

‡ For reasons that will become clear in the next section, I use the symbol  $m$  for the 'rate of profit' as defined above, rather than  $r$ .

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Okishio notes that in order for capitalists in this industry to choose a new technique, it must be cheaper; that is, when costed up under prevailing prices and wages, its unit cost-price  $k_j'$  must be lower:

$$k_j' < k_j. \quad (6)$$

At the ruling prices of output, the capitalist with the cheaper technique would make more profits per unit output; with higher profits per unit output and lower unit costs, the rate of profit would be higher. Thus another way to state the requirement for the adoption of a cheaper technique is

$$m_j' = \pi_j'/k_j' = (p_j - k_j')/k_j' > m_j = (p_j - k_j)/k_j. \quad (7)$$

That is to say, the *transitional* rate of profit of the new technique—the rate of profit which would hold at ruling prices and wages—must be lower if the new technique is to be adopted.

If the new technique is indeed established and becomes the ruling one, then new prices of production and a new average rate of profit  $m'$  will be formed. What the Okishio theorem proves is that the new average rate will be higher than the old average, due solely to the introduction of a cheaper technique (real wages being given) (Okishio, 1971, p. 99).

$$m' > m. \quad (8)$$

(iii) *The ambiguity in the Okishio theorem*

We have seen that, according to Marx, the 'battle of competition is fought by the cheapening of commodities'. However, Okishio finds that the cheapening of commodities (the reduction of unit cost-prices) will in general raise the average rate of profit, not lower it. Since the former process is a necessary aspect of competition, Okishio is forced to reject the latter (Okishio, 1961, p. 95). The laws of algebra, it would seem, have overcome 'the most important law of modern political economy'.

But algebra, like political economy, is not always what it seems. Okishio is right—but so is Marx. To see why and how, we must return briefly to an earlier discussion.

In section 3(ii) of this paper, we noted that for Marx mechanisation is a specific consequence of capitalist production relations, in which 'the increase in the productive powers [of labour] must be *paid for*' (Marx, 1973, p. 776; emphasis added) through the greater employment of machinery, the greater 'roundaboutness' of production (Marx, 1973, p. 777). This form of increased mechanisation implies increased stocks of fixed capital, and increases in the *stocks* of capital advanced per unit of output—these being the *principal means by which* the unit cost-price (i.e. the *flow* of capital used up per unit output) is lowered. As Schefold demonstrates, this is precisely what is meant by increased 'roundaboutness': a lower production cost per unit output is achieved by means of a greater investment cost per unit output.

Once the difference between production costs and investment costs is grasped, it immediately follows that there in fact exist two *different* measures of profitability: profits in relation to capital used up in production (i.e. in relation to cost-price), which I shall call the *profit-margin on costs*; and profits in relation to capital advanced, or the *profit-rate*. The former is a ratio of two flows, the latter a ratio of flow to stock.†

† A. A. Konus (1967) notes that Okishio does not treat fixed capital. But this only leads him to reserve judgement on the validity of Okishio's conclusion. He does not take the criticism any further than that.

Let  $K$  = unit investment costs in money terms. As before,  $k$  = unit cost-price (production costs), and  $\pi$  = unit profits. Then†

$$m \equiv \pi/k = \text{profit-margin on costs,} \tag{9}$$

$$r = \pi/K = \text{profit-rate.} \tag{10}$$

If we now return to Okishio's (and Marx's) assumption that capitalists must choose the method of production with the lower unit cost-price,‡ it becomes apparent that what Okishio has in fact demonstrated is that such a choice will raise the average profit-margin which corresponds to a given real wage.§ If we were to draw curves representing the wage/profit-margin trade-offs for different structures of production, || then it would follow that at a given real wage the curve with the highest profit-margin would indicate the set of techniques which the competition of capitals will bring into operation.

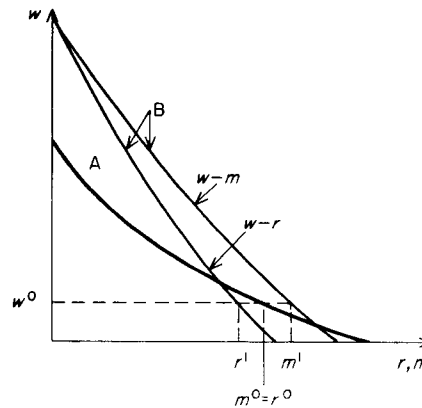


Fig. 1

As we have already noted, Schefold (1976A) has shown that mechanisation will raise the maximum real wage and lower the maximum rate of profit. Since the maximum real wage is the same for both the  $w-m$  and  $w-r$  curves, both curves will move outward along the  $w$ -axis, while at least the  $w-r$  curve will slide inward along the  $r$ -axis.

† In value terms  $\mu = s/(c+v) =$  profit-margin on cost-price, and  $\rho = s/(C+V) =$  profit rate.

‡ The implications of this choice criterion are further analysed in the next section.

§ Okishio's proof is based on a 'pure circulating capital' model. By abstracting from fixed capital Okishio in effect abstracts from machinery and hence the means by which the flow costs are lowered. Marx remarks that 'insofar as machinery develops with the accumulation of society's science, of productive force generally, [this] productive force of society is measured in *fixed capital*, [and] exists there in its objective form' (p. 694). With fixed capital absent, the *costs* of the development of productive forces are abstracted from, and only the benefits (in the form of reduced costs) are captured within this framework. This one-sided formulation naturally manifests itself as an ineluctably rising rate of profit.

It should be noted, incidentally, that in Marx the instruments of production (the means of labour) generally participate in multiple cycles of the *labour process*. This quality of 'durability' with respect to successive labour-processes is not altered by extending the period of observation (say from one year to several years). When instruments of production appear as elements of the capitalist labour-process, i.e. as part of capital, their 'durability' manifests itself as the fixity of capital—hence they appear as fixed capital.

Orthodox theory, on the other hand, tends to define fixed capital as means of production lasting longer than the period of observation (one year). Then by extending the period of observation sufficiently, it appears possible to reduce all capital to circulating capital only. In this way the distinction between fixed and circulating constant capital is reduced to a pure formality.

|| By a structure of production, I mean a set of methods (techniques) of production, one for each industry.

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It is now easy to show that the cheapening of commodities does not necessarily contradict the tendency of the rate of profit to fall. For the sake of diagrammatic simplicity, let us assume that the old structure of production has no fixed capital—so that its profit-margin and profit-rate are equal in magnitude throughout. Then the same curve (the heavy line in Fig. 1) represents both the  $w-m$  and  $w-r$  trade-offs for this structure.

Now consider a more mechanised structure in which the  $w-m$  curve satisfies the Okishio criterion by having a higher profit-margin at the given real wage  $w_0$ , and the  $w-r$  curve satisfies the Schefold criterion by having a lower maximum rate of profit (a numerical example is provided in Appendix 2).

As drawn in Fig. 1, at the given real wage the more mechanised structure has the higher average profit-margin and yet also a lower average rate of profit.† That is to say, the cheapening of commodities will lower not only the maximum but also the actual rate of profit—precisely because this cheapening ‘necessitates a costly and expensive apparatus’ (Marx, 1967, vol. I, p. 387). Rather than being incompatible, these two results are simply different aspects of the same contradictory process.

(iv) *Competitive versus optimal choices*

In his original article Okishio begins from the criterion of the cheapening of commodities and proceeds to the (mistaken) conclusion that the tendency of the rate of profit to fall is thereby excluded. We have seen, however, that in fact the former does not pose a barrier to the latter.

But Okishio’s negative conclusion can still be retained if it can be shown that there is an alternate path leading to it. And such a path does indeed exist, in the form of the argument that since capitalists ‘prefer’ a higher rate of profit to a lower one, they would ‘choose’ to adopt a method of production only if it raised their transitional rate of profit. Under these circumstances all new methods, if adopted, would end up raising the average rate of profit corresponding to a given real wage. Hence the technique which yields the highest rate of profit consistent with a given real wage is assumed to be the one which would actually be in operation at that wage. The concept of the wage-profit(-rate) frontier, which lies at the heart of the now famed Cambridge capital controversies, rests on precisely this basis.‡

† Figure 1 also demonstrates that if real wages are low enough (some  $w$  below the intersection of the two  $w-m$  curves), the more mechanised structure will not be feasible. Marx discusses this: ‘[A] fall in wages impedes the use of machinery. . . The Yankees have invented a stone-breaking machine. The English do not make use of it, because the “wretch” who does this work gets paid for such a small portion of his labour, that machines would increase the cost of production for the capitalist’ (Marx, 1967, vol. I, pp. 393–394).

‡ Sraffa (1960) defines the preferred method to be the one which has the lower price of production at the ruling rate of profit, as opposed to the lower cost-price (p. 81). This implies that the technique with the higher rate of profit at a given wage will be chosen. Sraffa’s own diagram illustrates this only for the case of ‘pure circulating capital’, in which case no distinction can be made between the profit-margin and the profit-rate criteria. The post-Sraffa literature, however, correctly generalised Sraffa’s criterion of a lower price of production to the concept of a wage-profit rate frontier. (For example, see Harcourt and Laing, 1971, Introduction and Part 5.)

In a critique of Marx’s law of the tendency of the rate of profit to fall, Samuelson (1957) argues for the same principle. In his case the grounds are that the choice of technique with a higher rate of profit enables ‘labor to have “capital”, pay it the going rate of profit, and keep the excess for itself in the form of a higher real wage’ (p. 894). Conversely, capitalists could hire workers at the going real wage and keep the excess as extra profits (n. 10, p. 894). Thus either way, the technique with the lower rate of profit would be ‘preferred’. Samuelson notes (without irony) that ‘in a perfectly competitive market it really doesn’t matter who hires whom’ (p. 894). Having already abstracted from capitalism itself, it is understandable that Samuelson abstracts from the competition of capitals.

In his later work, Dobb also comes to adopt this principle:

A capitalist *entrepreneur* faced with technical alternatives would presumably choose the most profitable (which would be that which yields the highest ratio of surplus to original investment cost) (Dobb, 1960, p. 42).

It should be clear by now that we are faced with two distinct criteria for deciding which technique will rule at a given real wage. The first, derived from Marx and employed by Okishio, is based on the notion that the cheapest method of production will win out in the wars among capitals. I shall call this the 'competitive criterion'.

The second criterion, which underlies the current 'choice of technique' literature, is based on the notion that capitalists employ only preferred alternatives—i.e. only those which raise their transitional rates of profit. I shall call this the 'optimality criterion'. In terms of Fig. 1, this criterion implies that if technique A (handicrafts) were ruling, the more mechanised technique B would not be put into operation; conversely, if B were ruling, mechanised production would be abandoned in favour of handicrafts.

In contrasting these two criteria, we begin by noting that whereas it is true that capitalists 'prefer' larger profits to smaller (hence a higher transitional rate), *other things being equal*, it does not by any means follow that their choice of technique can be guided by this abstract preference. For example, suppose that method A has a unit cost-price of \$100 and a selling price of \$120, so that the profit-margin on costs (and also the profit-rate in this case) equals 20%. Now suppose that at currently ruling prices the more mechanised technique B could produce the same commodity for \$50, but that owing to the heavy capitalisation involved it would only yield a rate of profit of 18%.†

According to the optimality criterion, no existing capitalist (nor any potential entrant) would choose the mechanised technique over the handicraft, because of its lower rate of profit. As Marx remarks, no capitalist 'ever *voluntarily* introduces a new method of production . . . so long as it reduces the rate of profit' (Marx, 1967, vol. III, ch. 15, p. 264; emphasis added).

But the point is precisely that within the battle of competition, the choice is not 'voluntary' in the above sense (at least, no more so than in any other type of war). Faced

† Since the ruling technique is the handicraft (A), its rate of profit is equal to the ruling rate, and its selling price is the ruling price of production for this commodity

John Eatwell has pointed out to me that since the mechanised technique has the lower rate of profit at the given ruling price, it must therefore require a price higher than the ruling one if it is to sell at a 'normal' rate of profit. In other words, its *transitional* price of production must be higher than that of the ruling technique. Moreover, since in the competitive struggle the more mechanised technique will drive prices low enough to ruin the handicrafts, the market price during this period of struggle will be below the transitional prices of production of either technique. He therefore asks: how does this process accord with Marx's notion of prices of production as the centres of gravity of market prices?

I can only say that this question raises a difficult issue which I cannot attempt to answer here. Part of the reason is that a fuller treatment of competition is required (including differential profits, individual value and average value, etc.) before Eatwell's question can be addressed. But another part of the problem lies in the fact that there exists very little work on the question of the concrete manner by which market prices are dominated by prices of production. In any case, it is an important issue which deserves further investigation. It should be noted, however, that the more mechanised technique would imply a higher rate of surplus value, a higher organic composition, lower unit values, and the possibility of a lower rate of profit (see the numerical example in Appendix 1). Since unit values are lowered, the average price of production must also be lowered when the new technique is generalised. These consequences are precisely the ones emphasised by Marx (1967, vol. III, ch 14, § V, pp. 239–240). What needs to be elucidated, therefore, is the relation of the process of transition between techniques to the notion of prices of production as centres of gravity of market prices.

with the possibility of a cheaper method of production, the first capitalist to make the move will be able to lower his price to a point where the others make little or no profits (or even suffer losses)—while still making a profit himself. At a price of \$99, for instance, all capitals using the old technique will be making a loss of \$1 per commodity, whereas the capitalist who switched first would be making a profit of \$49 per commodity—and expanding rapidly to take over the field! The only real choice left to the others is to switch or to die. Competition is warfare. No side in a war voluntarily chooses to lose, and few combatants voluntarily choose to die; but one side does always lose, and many do end up dying. It is in the nature of warfare that it cannot be characterised by a series of ‘voluntary’ choices among congenial outcomes.†

### 5. Summary and conclusions

The aim of this paper has been to trace Maurice Dobb's theory of crises, and to demonstrate its substantial difference from that of Marx. Like Marx, Dobb identifies a falling rate of profit as the basic cause of capitalist crises; but, unlike Marx, Dobb's falling rate is based on the requirement that wages rise sufficiently to offset the benefits of technical progress. Thus it is rising wages which ultimately cause crises; a rising organic composition appears in this analysis as an offsetting factor to an already falling rate of profit, not as a cause of the fall itself.

It has been argued above that Marx develops the necessity for mechanisation from the relation of capital to labour within the production process, and not from increases in real wages, as Dobb would have it. Such increases may of course induce further mechanisation, but they are not themselves the basic cause of it. On the contrary, since mechanisation means a rising productivity of labour, it widens the range within which the struggle over real wages can take effect without interfering with accumulation. From this point of view it is mechanisation which in fact makes a secular rise in real wages objectively possible (even though it also undercuts this possibility by replenishing the reserve army). A secular rising real wage in turn widens the scope for further mechanisation.

Having argued that mechanisation (as defined by Marx) tends to lower the maximum rate of profit, it became necessary (section 4) to address the counter-argument that the criteria by which capitalists evaluate techniques will automatically exclude any fall in the actual rate of profit. Further analysis, however, revealed that this latter proposition rests either on a conflation of profit-margins with profit-rates, or on a definition of capitalist ‘choice’ criteria which cannot be sustained from Marx's analysis of the competition of capitals. Once this point has been clarified, the apparent contradiction between the cheapening of commodities and the falling rate of profit is dissolved.

Much of what is said in this paper appears as a criticism of Dobb's theory of crises. But my intention has been to treat Dobb's work as I believe the work of any important thinker should be treated: seriously, and critically. The aspects of it that I have chosen to focus upon represent only a small part of his writings, of which much was written

† Thus, after observing that no capitalist ‘ever voluntarily introduces a new method of production’ if it reduces the rate of profit, Marx goes on to add: ‘Yet every such new method of production cheapens the commodities . . . [the capitalist] pockets the difference between their costs of production and the market prices of the same commodities produced at higher costs of production. . . His method of production stands above the social average. But competition makes it general and subject to the general law. There follows a fall in the rate of profit—perhaps first in this sphere, and eventually it achieves a balance with the rest—which is, therefore, wholly independent of the will of the capitalist (Marx, 1967, vol. III, ch. 15, pp. 264–265).

40 years ago. It is a measure of his work that even after all these years, we continue to learn a great deal from it. Insofar as we have progressed beyond parts of it, it is because our understanding has already been strengthened by Dobb's many great contributions.

**Appendix 1**

The discussion in section 4 of this paper can be illustrated by means of this simple numerical example. In what follows, it is assumed that all circulating capital turns over in one year, and that fixed capital (where present) lasts 10 years.†

Let the first structure be 'handicrafts', in which materials (*M*) are processed each year by workers (*N*) into either materials or food (*F*). The processes below represent the typical unit of production (i.e. factory) producing a given type of commodity.

$$1000M + 2000N \rightarrow 3000M$$

$$1000M + 2000N \rightarrow 3000F$$

Then unit values (in worker-years)‡ can be derived from the requirement that the value of each product equals the value of the means of production used up *plus* the value added by living labour.

$$1000 \lambda_M + 2000 = 3000 \lambda_M \text{ (worker years)}$$

$$1000 \lambda_M + 2000 = 3000 \lambda_F$$

Thus  $\lambda_M = \lambda_F = 1$  worker-year. By construction, this example is a case of equal organic compositions, so that prices of production are proportional to values. We may therefore take the ruling prices to be  $p_M = p_F = \$1$ . Now suppose the yearly real wage per worker is  $w = \frac{1}{2}F$ ; then the yearly value of one labour-power is  $\frac{1}{2}$  worker-years, so that surplus labour-time is  $\frac{1}{2}$  year per worker, per year.

Because there is no fixed capital here, the stock of capital will consist of advances for materials and wages only. In the typical factory for a given product, the price (and value) becomes as shown in Table 1.

**Table 1**

$C_M$	Stock		Total	Flow			Total price (value)	Unit cost	Profit margin	Profit rate
	$V$			$c_m$	$v$	$s$				
1000	1000	2000	1000 + 1000 + 1000 = 3000				0.66	50%	50%	

In this structure, the profit-rate and profit-margins are of course equal.§

Now consider a more 'roundabout' (mechanised) structure. Suppose it becomes possible to construct a machine (*K*) from materials and labour, and then to use it in producing food and materials. As possible investments we now have available a machine-making process, and two mechanised food and materials production processes.

$$1171 \frac{19}{111} M + 497 \frac{33}{111} N \rightarrow 2000 K,$$

$$2000 K + 1250 M + 1390 N \rightarrow 3750 M,$$

$$2000 K + 1250 M + 1390 N \rightarrow 3750 F.$$

† This means that we ignore variations in turnover within circulating capital, but not the difference between fixed and circulating capital.

‡ Given the length *h* of the working day, and the number of working days (*D*) in one year, one worker-year is *hD* hours. As long as these two elements remain constant, we can talk in worker-years rather than worker-hours.

§ In general,  $\rho = \text{profit-rate} = s/(C+V)$ , while  $\mu = \text{profit margin} = s/(c+v)$ .

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The currently existing structure is the handicraft one, with ruling prices of  $p_M = p_F = 1$ , a real wage  $w = \frac{1}{2}F$  and a ruling rate of profit  $\rho = 50\%$ . Under these circumstances, any capitalist contemplating mechanisation would find that it would cost  $\$2129\frac{81}{111}$  ( $\$1171\frac{19}{111}$  for materials,  $\$248\frac{72}{111}$  for wages, plus a 'normal profit'† of  $\$709\frac{101}{111}$ ) to acquire a complement of 2000 machines. Using these machines to make either food or materials would then imply the investment picture shown in Table 2.

**Table 2**

$C_F$	Investment		Total
	$C_M$	$V$	
$\$2129\frac{81}{111}$	$\$1250$	$\$870$	$\$4249\frac{81}{111}$

*Flows*

Price of output =  $\$3750$

Cost-price<sup>a</sup> =  $\$2332\frac{108}{111}$   
 $(\frac{1}{10} C_F + c_m + v)$

Potential profit =  $\$1417\frac{3}{111}$

Transitional unit cost-price =  $k' = \$0.622$

Transitional profit-margin =  $m' = 60.74\%$

Transitional profit-rate =  $r' = 33.34\%$

<sup>a</sup> This example is constructed on the basis of 'straight line' depreciation at a rate of 1/10 per year. Similar examples may be constructed using alternative depreciation procedures. The argument would not be fundamentally altered.

It follows that the more mechanised technique has a lower unit cost-price *but also* a lower transitional rate of profit than a comparable handicraft technique.

As we have seen in section 4, competition among capitalists will force the choice of the new structure. When this outcome is general, the new unit values will be given by

$$(1171\frac{19}{111}) \lambda'_M + 497\frac{33}{111} = 2000 \lambda'_K,$$

$$\frac{1}{10}(2000 \lambda'_K) + 1250 \lambda'_M + 1380 = 3750 \lambda'_M,$$

$$\frac{1}{10}(2000 \lambda'_K) + 1250 \lambda'_M + 1380 = 3750 \lambda'_F.$$

Thus  $\lambda'_M = \lambda'_K = \lambda'_F = 0.6$ . The new value of labour-power corresponding to the *given* real wage is  $\lambda'_F(\frac{1}{2}F) = 0.3$  worker years per worker, per year, so that the new value scheme is that shown in Table 3.

† The investment required at ruling prices to product 2000  $K$  is  $\$1419\frac{91}{111}$ , and the ruling rate of profit is 50%.



Table 3

	Stock			Total	Flow				Total value	Unit cost	Profit margin	Profit rate
	$C_F$	$C_M$	$V$		$c_f$	$c_m$	$v$	$s$				
(K)	0	$702\frac{26}{37}$	$149\frac{7}{37}$	$851\frac{33}{37}$	$0 + 702\frac{26}{37} + 149\frac{7}{37} + 348\frac{4}{37} = 1200$				0.426	0.4086	0.4086	
(M)	1200	750	414	2364	120 + 750	+ 414	+ 966	= 2250	0.342	0.7523	0.4086	
(F)	1200	750	414	2364	120 + 750	+ 414	+ 966	= 2250	0.342	0.7523	0.4086	

By construction, this structure has equal organic compositions.† Hence the new prices of production corresponding to this structure will be proportional to the new unit values, as evidenced by the fact that in the value scheme above the value rates of profit are all equal (so that no ‘transformation’ is required). Given the same value of money as before, the new ruling price magnitudes will be the same as those in value scheme. Consequently we may say that the mechanised techniques result in lower unit prices, lower unit costs, a higher rate of surplus-value, a higher profit-margin (on the average) and a lower rate of profit. These are precisely the consequences Marx attributes to mechanisation in general.

Lastly, since prices of production are proportional to values for both structures, we can derive the  $w-m$ ,  $w-r$  curves directly from value relations. In general, the maximum real wage is the reciprocal of the unit value of the wage basket (here, the reciprocal of  $\lambda_F$ ),‡ the maximum profit margin is  $l/c$  and the maximum profit rate is  $l/C$ . From the expressions above we derive the results shown in Table 4.

Table 4

	Maximum real wage	Maximum profit margin	Maximum rate of profit
Handicraft	1	2	2
Mechanised	$1\frac{1}{3}$	1.33 <sup>a</sup>	1.413

<sup>a</sup> Since profit-margins are not all equal in the mechanised structure, the average profit-margin (and the maximum profit margin) will vary according to the output proportions of the various types of commodities. The maximum profit margin shown above is calculated directly from Table 3 as the sum of living labour in all three processes divided by the corresponding sum of constant capital.

The diagram in Fig. 1 therefore corresponds to an example of the above type.

### Appendix 2: Mechanisation and the organic composition

When a capitalist undertakes an investment, part of the expenditure is translated into plant, equipment and materials, and the rest into purchase of labour-power. At this point, what was initially a sum of capital in the form of money is now in the form of productive capital (means of production, labour-power). Thus the total capital is preserved, but its form has changed.

† As a general proposition, equal value (and hence organic) compositions are both necessary and sufficient for prices of production proportional to values. See Schefold (1976B), §. 2.

‡ When the rate of profit is zero, prices may be written as  $\hat{p} = \hat{p}A + W\hat{l}$ , where  $A$  is the input-output flow matrix,  $\hat{l}$  is the vector of labour coefficients,  $\hat{p}$  the vector of unit prices, and  $W$  the maximum money wage. Then  $\hat{p} = W\hat{l}[I-A]^{-1} = W\hat{\lambda}$ . In the case of two departments,  $(\hat{p}_M, \hat{p}_F) = W(\lambda_M, \lambda_F)$ , so that  $\hat{p}_F = W\lambda_F$ . Taking the price of food as the *numéraire* implies that the maximum real wage is the reciprocal of the unit value of food:  $W/\hat{p}_F = 1/\lambda_F$ .

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In every society, including capitalist society, the labour-process involves the production of use-values. From this general point of view, the relevant distinction within productive capital is between means of production and labour-power—in other words, between the subjects/instruments of labour, and the capacity to labour itself. Let  $K$  = an index of the stock of means of production (such as a constant-dollar index), and  $N$  = the number of workers which this stock can employ.† Then what Marx calls the *technical composition* of capital (in orthodox terms, the 'real capital-labour ratio') is:

$$T = K/N = \text{technical composition.}‡$$

In capitalist society, however, the labour-process is not merely a process of producing use-values, but rather one whose dominant aspect is the production of surplus values—i.e. the expansion of capital. From this latter point of view, therefore, the value of the initial capital advanced has two distinct components: the stock of capital ( $C$ ) advanced for constant capital, and the stock ( $V$ ) advanced for variable capital. Their ratio  $C/V$  Marx calls the *value composition* of capital.

Let  $\lambda_M$  = an index of the unit value of means of production: then  $C = \lambda_M K$ . Let  $\lambda_F$  = an index of the unit value of means of subsistence,  $n$  = the number of yearly turnovers of variable capital and  $w$  = an index of the yearly real wage per worker; then  $v = \lambda_F w N$  = the yearly value of the labour-power of  $N$  workers (flow) and  $V = v/n$ . On this basis we may write the value composition (the equivalent ratio in price terms is the 'capital-wage fund ratio' in current dollars) as:

$$C/V = (\lambda_M/\lambda_F) (1/w)nT = \text{value composition.}$$

Having distinguished the technical and value compositions, Marx goes on to say:

I call the value composition, in so far as it is determined by its technical composition and mirrors the changes in the latter, the *organic composition* of capital (Marx, 1967, vol. I, ch. 25, §2, p. 612).

Consider what the value composition does in fact mirror. First, it mirrors mechanisation, which raises the technical composition  $T$  and lowers the unit values  $\lambda_M$  (producer goods) and  $\lambda_F$  (consumer goods). As we noted earlier (p. 238), however, in deducing the general law Marx abstracts from any long-term differential movements in the unit value of the two departments—precisely because all capitals are subject to the necessity of technical progress, a necessity which competition enforces upon them with ruthless despatch. On this basis, therefore, the value composition will tend to reflect changes in the technical composition, in the sense that the latter will dominate the former.

In addition to the effects of mechanisation, the value composition also reflects changes in the real wage  $w$  and in the average number of turnovers  $n$ , increases in the former lowering the value composition and in the latter raising it. But the influence of turnover time on the rate of profit is strictly limited, so that at the most general level it is possible to abstract from variations in  $n$ . As for variations (particularly increases) in the real wage, it is clear that Marx wants to emphasise that the tendency of the rate of profit to fall comes about independently of any tendency for real wages to increase.§ Thus, when discussing the general laws of the rate of profit, in addition to abstracting from variations in turnover time (because of their limited scope) Marx also abstracts from increases in real wages—precisely because neither of these is fundamental to the tendency for the rate of profit to fall. In other words, he focuses primarily on those movements of the

† Under capitalism, it is the means of production which 'employ' workers, not *vice versa*. Thus  $N$  refers to the number of workers employed by full capacity utilisation of the stock. To measure the technical composition it is therefore necessary to correct actual employment to its normal capacity level.

‡ The concept of the technical composition of capital presupposes a general method for constructing indexes of heterogeneous use-values, which in some sense distinguish between nominal and real changes. This so-called 'index number problem' is well known in orthodox analysis. In Marxist analysis the dual concepts of 'real-wages' and 'productivity of labour' rest precisely on a connection between a unit of labour power and a heterogeneous and historically changing mass of use-values.

§ 'The tendency of the rate of profit to fall is bound up with a tendency of the rate of surplus-value to rise, hence with a tendency for the rate of labour exploitation to rise. Nothing is more absurd for this reason, than to explain the fall in the rate of profit by a rise in the rate of wages, although this may be the case by way of an exception' (Marx, 1967, vol. III, ch. 10, p. 240).

The fact that Marx rejects rising real wages as the fundamental cause of the falling rate of profit does not in any way imply that he believed real wages would not rise. On the contrary, the same process—the development of the productivity of labour via mechanisation—which gives rise to a falling rate of profit also makes possible a widening of the limits on the increases in real wages (see p. 246 and n. †, p. 237 above).

value composition which reflect movements in the technical composition, because it is from these latter movements that his basic laws emerge.

In formal terms, we define the *organic composition* to be the value composition for a given real wage and number of annual turnovers. Clearly, if technical progress is more or less general across departments, the organic composition will tendentially reflect changes in the technical composition. The value composition, on the other hand, in so far as it differs from the organic composition (i.e. in so far as real wages are rising secularly) will lag behind.

We can now identify two further weaknesses in Dobb's presentation. First, he is incorrect when he asserts that even with given real wages the value (and hence, organic) composition will lag behind the technical composition. This would only be true if technical progress were confined primarily to producer goods. More importantly, he fails to notice that a rising organic composition implies that the demand for labour will grow more slowly than the rate of accumulation, so that it takes an 'accelerated accumulation of total capital, accelerated in a constantly growing progression' (Marx, 1967, vol. I, p. 629) to maintain any particular rate of growth of employment. According to Marx mechanisation not only constantly replenishes the reserve army, it also gives rise to a tendency for employment to stagnate (see Okishio, 1972). This is very different from Dobb's scenario for monopoly capitalism, with its tendency toward scarcity of labour.

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