Accumulation of capital and the rate of profit in Marxian theory

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Introduction

There has recently been a resurgence of interest in the proposed law of the falling tendency of the rate of profit in Marxian economics.[1] This recent discussion has once again brought to light a long-standing and wide-ranging controversy regarding the meaning and validity of this proposed law and its exact status within Marxian theory as well as its actual empirical relevance.[2] The debate has moved back and forth between two poles. On the one side claim is made to the validity and essential significance of the law as a general and all-pervasive feature of the process of expansion and development of the capitalist economy. It is supposed to follow from the inner logic of capital-in-general and to correspond therefore to the most basic element in Marxian analysis. On the other side it is argued that the proposed law is really a contingent proposition, indicating one of many possible outcomes and dependent on specific historical circumstances that are not necessarily characteristic of the accumulation process in general. It is therefore to be regarded, for instance, as specific to a particular phase of the overall process of capitalist development or as one of many possible conditions operating within a particular phase.

There can be no question as to the important place which this law occupies within the framework of Marxian economic analysis viewed as a whole. Marx himself assigned great significance to it. He regarded it as 'the most important law of modern political economy'.[3] Moreover, it is important for a definite reason lying within Marx's own analysis that is worth recognizing. Marx set himself the task of discovering the barrier to capitalist production within the process of capitalist production itself, as distinct from an external barrier arising from presumably 'natural' causes such as were to be found in classical political economy.[4] If the barrier to the continuation of the capitalist process is internal to that process,

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[1] Some relevant references to recent work are: Cogoy (1973), Fine and Harris (1976), Himmelweit (1974), Lebowitz (1976), Okishio (1961, 1972, 1977), Shaikh (1978), Sweezy (1973), Weisskopf (1979), Yaffe (1972).

[2] For earlier discussions, see: Dickinson (1959), Dobb (1940), Gillman (1957), Mattick (1959), Meek (1967), Rosdolsky (1977), Sweezy (1956). A central role in these earlier discussions was played by the contribution of Robinson (1947). For her latest contribution to the debate, see Robinson (1978).

[3] *Grundrisse*, p. 748. His most detailed argument on the law is in *Capital*, III, part III.

[4] In the recent discussion, there has been a tendency to lose sight of the specific intellectual background of the Marxian analysis and, in particular, the roots of Marx's own conception of the problem of a falling rate of profit in his efforts to grapple with classical political economy. These roots are examined in Harris (1979) and in Sweezy (1981). Tucker (1960) documents the long history of the idea of a falling profit rate and its place in British economic thought up to the middle of the nineteenth century. There exists also a distinct conception of a falling tendency of the profit rate in neoclassical theory, specifically in its Austrian and aggregate production function versions (see Harris, 1981A). Though it is based in each case on quite different considerations, this conception is nevertheless one of the more striking uniformities across different schools of economic thought.

to its own inner drive for expansion, then it follows that the capitalist process is inherently self-limited so as to drive toward its own internal transformation. In seeking to discover that barrier, Marx hit upon the law of the falling tendency of the rate of profit as its foremost expression. Specifically, capital has a necessary drive to expand, Marx argues, and, in that drive, an inevitable tendency to revolutionise the techniques and methods of production so as to 'ripen the productive power of social labour'. But that very same process of developing the productive forces in such as to entail reduction of the well-spring from which the expansion proceeds, which is the rate of profit itself. Thus, accumulation of capital erodes and eventually eliminates the very basis of its continuation through the falling tendency of the rate of profit. This law thereby expresses the existence of an internal contradiction inherent in the general dynamics of the process of capitalist accumulation and development.[1]

Thus within Marx's overall analysis this proposed law does have a significant place. There is apparently, then, much that is at stake in considering the validity of the law. But to question its general validity, or to argue that the law itself is contingent, is not to reject the whole of Marxian economic theory. Of course, if one takes the 'fundamentalist' position that all the theory hangs or falls on this single law, then that conclusion certainly follows.[2] But it would seem, in that case, that it is really that position which is at stake. Rather, what is called into question is the presumed generality and persistence of the conditions which are supposed to give rise to the proposed law. What is required then is to examine carefully the logical basis of the proposition within the Marxian conception of the accumulation process as a whole. This in turn requires a systematic investigation of that conception in order to discover within it the exact locus of the presumed necessity of this law and the limitations and deficiencies, if any, associated therewith.

It is at this point that one sees a great weakness in the current discussion of the proposed law. What is missing from this discussion is an explicit account of the specific economic process, its actual mechanisms, interdependencies, and determining conditions, which supposedly produce this tendency as a result of that same process. In the absence of a satisfactory analytical treatment of this problem, much of the current argument intended to support or refute the law appears to be highly tautological and the law itself appears to have no systematic force.

This paper is intended as a contribution to filling this gap. The focus of attention is on the logical basis of the presumed necessity of a falling tendency of the rate of profit resulting from the interactions taking place within the accumulation process. In order to investigate this problem in detail, an explicit analytical construction of the accumulation process is presented in terms of a simple model. The model incorporates structural relations and assumptions regarding the mechanism of wage determination and the form of technical change that are considered to be representative of usual Marxian presumptions. Analysis of this model yields results which throw light on some of the central theoretical issues involved in the proposition of a falling tendency of the rate of profit. The argument is presented in the simplest possible terms so as to bring out the essential elements of the problem and to pose sharply the central issues.

The analysis is situated at the level of the 'aggregate capital'. This standpoint is expressed specifically in the assumption of a uniform organic composition of capital. This is the level at which it has all along been presumed that the proposed law of falling tendency

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[1]See *Capital*, III, pp. 249–250; *Grundrisse*, pp. 749–750.
[2]For a characterisation of the 'fundamentalist' position, see Fine and Harris (1976).

of the rate of profit applies. In this respect, this paper represents an attempt to assess how far it is possible to go in deducing a 'law of motion' at this level of analysis. The limitations which emerge are precisely those which derive from an analysis conducted at this aggregate level. To transcend these limits would require a different analysis, specifically, one which focusses on the process of *uneven development* of the different sectors of capital and the laws which emerge therefrom. This will be the subject of another work.

The argument of Marxian economics

The customary presentation of the Marxian argument is based on Marx's formula for the rate of profit.[1] Thus, define the rate of profit as

$$r = \frac{S}{C + V}$$

where the right-hand side is total surplus value S divided by the total capital consisting of constant capital C and variable capital V, all measured in terms of embodied labour or labour value.[2] Since total surplus value is a deduction from value added by currently employed labour after replacement of variable capital, so that $S = L - V$, this formula can be redefined. Accordingly, after dividing through by L we get

$$r = \frac{1 - v}{q + v}, \quad v = V/L, \quad q = C/L \tag{1}$$

where v is the value of labour power and, by commonly accepted practice, q is taken to be the organic composition of capital.[3] It follows immediately that, if v is given at some specified level or has a lower limit (equivalently, if there is a given level or upper limit of the rate of exploitation S/V), and if the organic composition rises indefinitely, then the rate of profit must correspondingly fall. Stated concisely: if $v \geq v^\star$ and q rises indefinitely, then r falls. Evidently, this statement, as it stands, is purely tautological. It follows by definition. One obvious question that it raises is: why should v be assumed to be given or bounded, and at what level? One may note here that, conceptually, v is composed of

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[1] See, for instance, Meek (1967, pp. 129–142).

[2] As is now well known, this formula holds only if we abstract from conditions which drive a wedge between labour values and prices of production. It holds specifically if it is assumed that the conditions of production are uniform across all industries so that the organic composition of capital is the same. It is this assumption that is made throughout the present analysis. Furthermore, assumption of a pure circulating capital model with uniform production period gives ready economic meaning to C as the labour value of used up means of production. V consists of wages advanced at the beginning of the period.

[3] There is disagreement in the literature about the appropriate measure of the organic composition of capital, that is, whether it should be q or q/v. In using q we follow a now common practice which distinguishes q/v as the 'value composition of capital' from q as the organic composition. The latter is the ratio of labour embodied in means of production (dead labour) to currently employed (living) labour and, as such, may be taken to represent changes in production conditions independently of distributional changes. Both measures give the same result if v is constant. When output is measured in terms of currently employed labour, the organic composition in this sense is equivalent to the familiar concept of 'capital–output ratio' if capital is defined to include only constant capital. But since capital is here conceived as both means of production and wage advances, the capital–output ratio is properly defined as $q + v$ which, in this context, is the same as the capital–labour ratio. The case for including wage payments as an element of total capital is argued in Harris (1981B).

the real wage w, representing a quantity of commodities, and the amount of labour embodied (directly and indirectly) per unit of those commodities. By definition, we have

$$v = w\lambda. \tag{2}$$

The labour value λ may be expected to fall with technical change and, hence, as a direct consequence of the presumed rise in q. For v to remain at or above some predetermined level presupposes a corresponding rise in w such as to offset the fall in λ. The question that is begged, then, is: how are such synchronic movements in v and λ to be explained? Furthermore, why should q necessarily rise with technical change? It could just as well be taken to fall or to remain constant, in the absence of some definite account for the necessity of its increase.

Another current line of reasoning is that the rise in q entails a continuing decrease in the level of the *maximum* rate of profit.[1] Since this maximum sets an upper limit on the actual rate of profit, then it is argued that, whatever happens to the actual rate of profit in the interim, it must *eventually* hit up against the maximum and consequently fall. This argument is considered to follow from the same formula for the rate of profit. Note that, in equation (1), the rate of profit is at a maximum when $v = 0$ and correspondingly $r = 1/q$, so that the maximum falls as q rises. But even if the *maximum* profit rate falls, it does not necessarily follow that the *actual* rate falls. The maximum could fall asymptotically to a positive level which is above the actual rate. Moreover, it is clear from considering this argument that, if such a situation of convergence of the actual rate to the maximum were to occur, it would entail that the wage itself had fallen to zero, requiring elimination of the possibility of securing labour for continued production. Alternatively, it presupposes that the conditions of production develop to the point that $\lambda = 0$, implying that production occurs without use of labour, which is a highly implausible outcome. Whatever the case, the argument posits some remote eventuality occurring at some distant point 'in the future' and, until that point is reached, the actual rate of profit could be rising, falling, or fluctuating. There is no saying in what direction it moves solely on the basis of this argument. Taken by itself, this argument therefore provides no explanation of movements in the actual rate of profit, or in the wage. We are therefore left with the same set of questions as to what accounts for such movements.

A more constructive treatment of the problem is reported in the seminal paper of Okishio (1961) which shows that the rate of profit may not fall with technical change and must rise if the real wage remains the same.[2] It is inconsistent with competitive behaviour for the rate of profit to fall unless, correspondingly, the real wage rate rises sufficiently to offset the potential increase in the profit rate due to technical change. This result may be interpreted to mean that, if the rate of profit falls, it is to be viewed as a contingent phenomenon, not a generalised necessity. Specifically, it is contingent on a sufficient rise in the wage. The natural question to ask then would be: What is it that governs wage movements so as, in fact, to bring about increases in the wage? Are such increases in the wage likely or not to counteract the rise in the profit rate due to technical change? To answer this question evidently requires an explicit conception of wage determination in the context of the accumulation process.

The questions raised here reflect objections that have been made in various ways by numerous authors to the Marxian presumption of a necessary tendency for the rate of profit

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[1] See Okishio (1972), Himmelweit (1974), Shaikh (1978).
[2] This point was also made in an earlier paper by Samuelson (1957).

to fall. They all point to the necessity of providing some explicit analytical account for the direction of movement of the relevant variables and the causes governing that movement. In this connection, one may note an elementary point. This is that the equation for the rate of profit (1), if we substitute in it the definitional relation (2), represents only one equation in the four unknowns: r, q, w, λ. In order to obtain any determinate result as to the movement in the rate of profit, it is necessary to supply a determination of the other three variables rooted in an appropriate theoretical conception of the accumulation process as a whole. In the absence of that determination the proposition of a falling tendency of the rate of profit must indeed appear to rest on a purely tautological foundation.

In order to pursue these questions further, an effort is made here to develop an analytic treatment of the problem. Accordingly, I proceed next to construct a simple model of an expanding economy incorporating structural relations and behavioural conditions that are deemed to be consistent with usual Marxian presumptions. Systematic analysis of this model makes it possible to follow through the logic of those presumptions and to derive their implications for trends in the relevant variables in the course of the accumulation process. In this way, it is then possible to confront directly the theoretical basis of the presumed necessity of a falling tendency of the rate of profit.

A simple model

For this construction, we abstract from the existence of land and associated payment of ground rent. Production takes place by means of produced commodities and labour. Production conditions are such that the organic composition of capital is uniform across all departments and all capital goods are used up in a single period. The length of the working day is taken as given. We abstract also from problems of realisation of the value produced.

For given production conditions specified by given values of λ and q, equations (1) and (2) define a relationship between the wage rate and rate of profit, or wage–profit curve. This curve is convex, with intercepts at $w^\star = 1/\lambda$ and at $r^\star = 1/q$. The usual Marxian presumption is that technical change takes the form of an increase in the organic composition of capital which brings about an increase in the productivity of labour. Thus technical change raises q and lowers $r^\star$; correspondingly, it reduces λ and raises $w^\star$. This may be represented in a diagram (see below) as a sequential lowering of the wage–profit curve as the vertical intercept shifts down and the horizontal intercept shifts out.[1] This presumption about the character of technical change implies that the level of productivity of

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[1]Robinson (1978) presents a related diagrammatic treatment of technical change which allows for other possible forms of technical change (compare also Schefold, 1976, 1979). Since she neglects wage–capital, her wage–profit curves are straight lines. And by distinguishing between 'men employed' and hours worked there is a divergence between the capital–labour ratio (capital per 'man') and capital–output ratio. On this basis she defines the characteristic Marxian case of technical change as a rise in the capital–labour ratio associated with a fall in the capital–output ratio (1978, p. 11). But it would seem more in keeping with Marx's analysis to assume that the increased investment per unit of labour necessary to take advantage of more mechanised techniques is more than proportional to the increased productivity of labour on the new techniques, so that the capital–output ratio increases along with the capital–labour ratio. This is the case assumed here and it is similar to her case of 'quasi-Alpha' (1978, p. 13). It must be added that there is nothing 'inconsistent' in the condition implied in this model that the capital–output ratio and capital–labour ratio are the same. It is simply a consequence of measuring output and employment in hours worked. Where shift work and variation in working hours are allowed, the difference between 'men employed' and hours worked that Robinson (1978, p. 14) identifies would come into play. Otherwise, it only complicates the argument.

labour (direct and indirect) is uniquely and positively related to the organic composition of capital.[1] Accordingly, we write

$$\lambda = \lambda(q); \ \lambda' < 0 \tag{3}$$

$$q = f(t); \ f' > 0. \tag{4}$$

Accumulation of capital takes place through the reinvestment of profits and it is assumed that a certain proportion a of the profits is reinvested in each period.[2] Thus, the rate of accumulation is given by

$$\frac{\dot{K}}{K} = ar, \ a \leqq 1 \tag{5}$$

where total capital is $K = C + V$. Employment of labour must satisfy

$$L = \frac{C}{q} = \frac{V}{v}.$$

It follows that

$$L = \frac{K}{q + v}$$

which implies the rate of growth of employment

$$l = \frac{\dot{K}}{K} - \frac{\dot{q} + \dot{v}}{q + v}. \tag{6}$$

Wages are assumed to be determined by a mechanism which is sensitive to the state of the labour market. In particular, when employment is growing more rapidly than the available labour force, so that the reserve army of unemployed labour is diminishing, workers are in a position to push up wages. In the opposite case, wages tend to fall. This mechanism incorporates what might be called the 'reserve army effect'. It presumes that competition between employed and unemployed labour serves to hold wages down and that the degree of competition varies with the size of the reserve army.[3] Even with this mechanism, however, some additional hypothesis is required concerning how increases in the real wage

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[1] Viewed in purely formal terms, this construction has a noticeable similarity to the 'surrogate production function' of Samuelson (1962). The similarity is unavoidable since both constructions are based on the same assumed condition of uniformity in the organic composition of capital. However, this is a case of formal similarity with important conceptual differences. In particular, this construction is a schematic representation of technical change (with or without a falling rate of profit), whereas the neoclassical construction uniquely represents *substitution* among existing alternative techniques in response to a declining profit rate. Furthermore, no use is made here of any supposed marginal productivity conditions and other relations which are necessary to support the neoclassical theory of distribution and growth (on this, see Harris, 1980).

[2] For generality the rate of reinvestment could itself be made a variable but we forgo that consideration here.

[3] This element of Marx's analysis is generally recognised, but it is specified in different ways by different authors. For instance, Steindl (1952, p. 232) suggests making the level of the wage a function of the rate of unemployment. Goodwin (1967) adopts an alternative specification which makes the rate of change of wages depend on the rate of employment so that the wage is constant at only one rate of employment and either rising or falling at every other rate. By contrast, in the present analysis, the wage is constant (in the absence of productivity growth) as long as the rate of employment is constant, whatever that rate may be.

might be supposed to occur in the course of development of the economy (if the rate of unemployment remained the same). Accordingly, it is assumed here that the change in wages, at a given rate of employment, is dependent on the change in productivity. Thus, on these grounds, there exists a dynamic wage adjustment mechanism which may be represented by

$$\frac{\dot{w}}{w} = \phi(l - n) - b \, \frac{\dot{\lambda}}{\lambda}, \quad \phi(0) = 0, \, \phi' > 0, \, b > 0 \tag{7}$$

where l and n are rates of growth of employment and of the total labour force respectively and b is a parameter measuring the sensitivity of wages to productivity change.[1]

The total labour force available for employment is in part determined by independent forces. It is also determined, in part, by the pressure of accumulation itself, insofar as expansion takes place, for instance, through the erosion of surrounding non-capitalist sectors. These conditions are expressed by making the growth rate of the labour force the sum of two components:

$$n = m + k(\frac{\dot{K}}{K} - g), \quad 0 < k < 1, \quad \frac{\dot{K}}{K} - g \geqq 0. \tag{8}$$

The first term, $m = $ constant, incorporates the independent factors. The second term incorporates the role of accumulation above some minimum rate g in creating additions to the labour force, where the parameter k measures the size of this effect. This specification may be taken to mean that capitalists actively seek out sources of labour supply instead of passively taking what is available to them from 'normal' growth of the labour force. Furthermore, the search yields additions to the labour force only when the rate of accumulation exceeds a certain threshold level, either because lumpy investments are required or because the search itself is intensified above a certain rate of accumulation. For this search to be economically relevant, as we shall see, the threshold level must be sufficiently low. Specifically it is required that $g < m$. It is assumed throughout that this condition is met.

This completes the statement of the relations of the model. The question to be asked now is: how does continued accumulation take place in such a system? And what are the consequences for the evolution of profits and wages?

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[1]To be consistent with Marx's analysis, it is necessary to assume that this mechanism works only within certain limits of the real wage as related to historically given requirements of reproduction of both capital and labour. Marx's arguments on this are surveyed by Ong (1980). In addition, Marx argued that: 'Between the two limits . . . an immense scale of variations is possible. The fixation of its actual degree is only settled by the continuous struggle between capital and labour, the capitalist constantly tending to reduce wages to their physical minimum, and to extend the working day to its physical maximum, while the working man constantly presses in the opposite direction. The matter resolves itself into a question of the respective power of the combatants' (Marx and Engels, *Selected Works*, p. 266). As to how this 'question of the respective power of the combatants' should be dealt with analytically, Marx did not develop a systematic argument. But in his analysis of the accumulation process, he left no doubt that the 'power of the combatants' was crucially related to the movements of the reserve army and, hence, conditioned by the process of accumulation itself. On this see, for instance, *Capital*, I, ch. 25. The specification adopted here gives an expression to the role of these forces. It also leaves room for other independent forces to operate through shifts in the function $\phi(\cdot)$ and in the adjustment parameter b. For a relevant discussion of the various strands of Marx's reasoning on the problem of wage determination, see Rowthorn (1980).

The case of constant organic composition

To simplify the analysis of accumulation, take first a case in which there is no change in the technique of production, so that

Case 1: $\dot{q} = \dot{\lambda} = 0.$

In this case the growth of employment is given by

$$l = ar - \frac{\dot{w}}{w} \left(\frac{v}{q + v}\right). \tag{9}$$

If, at the initial level of the wage, the growth of employment exceeds the growth of the labour force, the wage is driven up in accordance with (7). Correspondingly, the rate of profit falls and, with it, the rate of accumulation. This depresses the rate of growth of employment. In the opposite case, the wage rate falls and the growth of employment increases. These consequences follow from the operation of the reserve army mechanism. This mechanism, therefore, tends to bring about a balance between the growth of employment and growth of the available labour force. At the point of balance we must have $l = n$. This is satisfied, in the case of constant organic composition, by the conditions

$$\left.\begin{array}{c} \dfrac{\dot{w}}{w} = 0 \\[2em] r = \dfrac{m - kg}{a(1 - k)} \end{array}\right\} \tag{10}$$

The second condition holds for g small enough, that is, $g < m$, which is assumed to be the case. Otherwise, for $g \geq m$, it must be replaced by $r = m/a$. The solution is illustrated in Fig. 1. For any level of the wage below w_0, the interaction of accumulation and the reserve army drives up the wage. Above w_0, the same mechanism works in reverse. Thus, the point (r_0, w_0) represents the level of the profit rate and wage rate consistent with balanced growth of employment and supply of labour.
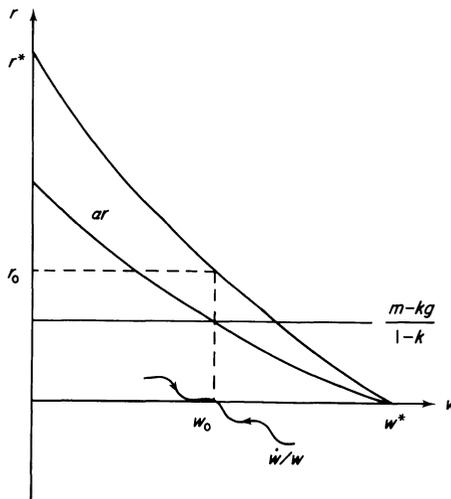

Fig. 1.

It is possible to offer two distinct economic interpretations of this case and it is useful to consider these in turn in order to make a connection with familiar Marxian arguments. One interpretation is that it represents a mechanism of adjustment operating in a period in which conditions of production are relatively fixed and there is a given rate of inflow of labour into the economy.[1] It indicates that, under such conditions, if there exists a tendency for wages to rise (fall) owing to the pressure (weakness) of accumulation relative to the growth of labour supply, then that tendency will be checked by the effect of the change in wages on the rate of accumulation. It follows that, within the accumulation process itself, there exists a self-correcting mechanism such as to preserve the wage and rate of profit at the level consistent with continuing accumulation of capital.[2] The existence of such a mechanism is an implication of Marx's extended argument about the character of the accumulation process under the assumed condition of a constant organic composition of capital.[3] That mechanism implies, in turn, that it is in periods of rapid accumulation (relative to the growth of labour supply) that the lot of the workers tends to improve, and *vice versa* in periods of depressed accumulation. It implies also that *the struggle over the wage has an inherent limitation in the process of accumulation itself*. For instance, if workers were to succeed in raising the wage above the established level, the process of accumulation would force it down again. Correspondingly, if the wage were depressed, the pressure of accumulation would drive it up again. Thus, the struggle over the wage is systematically mediated by the accumulation process in such a way as to defeat any tendency for wages to rise above or fall below the level consistent with the conditions of production, accumulation and growth of labour supply.

However, this self-correcting mechanism operates only so long as the growth rate of the labour force is sufficiently large. But what if the rate is 'low', say $n = 0$? Then there exists a situation in which, starting from a high level of the profit rate, the wage is pushed up to the maximum level and the rate of profit correspondingly falls so as eventually to bring accumulation to a halt. This brings us to another possible interpretation of this case. Specifically, this case indicates that, in a situation in which the conditions of labour supply are highly 'inelastic', then capital faces a barrier to its expansion in the limited labour supply. That barrier is expressed in a tendency for wages to rise so as to erode profitability and ultimately to bring the process of accumulation to a halt. This tendency may be counteracted by successive waves of inflow of labour. But if there is no regularity or systematisation to such inflows, this tendency must ultimately prevail. Therefore, if accumulation is to continue, something must give'. That is to say, the barrier must be eliminated and a new condition introduced to take its place.[4]

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[1] The relevant period involved here would be, say, that of a 'short' cycle.

[2] It should be obvious that this argument, by itself, does not propose any necessary equilibrium tendency in the operation of the capitalist economy. It says only that, if there is any presumed tendency to collapse or breakdown, it cannot be supposed to arise from this source.

[3] *Capital*, I, ch. XXV, section 1.

[4] This interpretation may be seen to have a connection with certain historical discussions to be found in Marx's texts and in subsequent literature, concerning the nature of 'primitive accumulation' and of capitalist expansion in 'backward' regions (see *Capital*, I, part VIII; also, Bradby, 1975, and Levine, 1975). Specifically, it could be said that this situation conforms to an early or 'backward' stage of capitalist development. In that stage, capital comes into existence without a fully proletarianised labour force and resting on production conditions that are relatively fixed or 'given' to capital. Accumulation of capital then tends to drive up the wage so that there exists an immanent tendency for the rate of profit to fall. The primary obstacles to accumulation in that phase, which account for the falling tendency of the profit rate, it is argued, are the limitations of labour supply and fixity of production conditions. Historically, the condition which counteracts that tendency may be seen to arise from access to non-capitalist sectors from which a labour supply can be drawn. But the tendency itself would persist as long as capital continued to rest on such conditions or until those conditions themselves changed.

One such condition would lie, as we shall see from considering the next case, in a rising organic composition of capital. Could it be said, then, that the rising organic composition is *induced* by the pressures arising from the tendency of wages to rise? It is sometimes suggested that this was Marx's view.[1] But, even so, it must be recognised that this would be an inadequate basis on which to constitute a theory of rising organic composition as a necessary feature of technical change. Two issues are involved here. First, technical change as such does not require to be stimulated by a growing shortage of labour. Rather, it is one of the instruments through which individual capitalists seek to increase their profits and gain an edge in the competitive struggle. Hence, it is an intrinsic feature of the ongoing process of accumulation and of competition of capitals. Secondly, as regards the particular *form* of technical change, it seems likely that a shortage of labour, insofar as it gives rise to rising wage rates, would stimulate introduction of labour-saving devices which reduce labour cost per unit of output. But such innovations are at least as likely to occur in the production of capital goods as in the production of consumer goods. Hence, there is no necessary reason in this stimulus, taken by itself, why the value of capital relative to labour (or to output) should rise and, furthermore, that it should do so indefinitely. So far as the necessity of any trend in the organic composition is concerned, therefore, it still remains an open question.

The case of rising organic composition

Consider next the case of a rising organic composition of capital, which implies

Case 2: $\dot{q} > 0,\ \dot{\lambda} > 0.$

Evidently, many different and complex motions of the system are now conceivable, depending crucially on the exact time path of q and on the associated movements in employment and wages. To simplify the analysis, assume that $b = 1$ so that, at a constant rate of employment, $\dot{w}/w = -\dot{\lambda}/\lambda$, and hence $v = v_0$. Note that this condition entails a specific hypothesis concerning wage determination. In particular, it proposes that, in the context of productivity growth and with balanced employment, the wage rises by just enough to offset the fall in labour value (or the rise in labour productivity) so as to keep the value of labour power constant.[2] Assume also that $l = n$: employment expands in step with the labour force so that the rate of employment, or the relative size of the reserve army, is kept constant. Accordingly, we have

$$l = ar - \frac{\dot{q}}{q + v_0} = m + k(ar - g) \tag{11}$$

from which follows

$$r = \left\{(m - kg) + \frac{\dot{q}}{q + v_0}\right\}[a(1 - k)]^{-1}$$

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[1] See, for instance, Sweezy (1956, pp. 88–89), Dobb (1940, pp. 102, 127). Adoption of this view would make the Marxian position on this issue indistinguishable from the neoclassical theory of 'induced bias' in innovation, as Dobb explicitly admits.

[2] This is to emphasize that, if one assumes a given value of labour power (or given rate of exploitation) it must be because of a specific hypothesis concerning the operation of the labour market. Otherwise, one would have to give up the idea of a labour-market determined real wage and resort to some other determination not yet specified. Until such a determination is provided, the mere assumption of a given rate of exploitation would remain without any behavioural content, hence lacking in any basis on which to choose between this or any other such 'given'.

and by using equation (1) to eliminate r we get

$$\dot{q} = a(1 - k)(1 - v_0) - (m - kg)(q + v_0) \tag{12}$$

This equation evidently implies a definite time path of q. It converges to a stable solution at $q = \bar{q}$ such that

$$r = \frac{1 - v_0}{\bar{q} + v_0} = \frac{m - kg}{a(1 - k)}$$

Thus, for balanced employment, the organic composition must adjust to a definite level, that level which, at the given value of labour power, is consistent with the rate of profit required to keep accumulation in line with the growth of labour supply. (This is the same level of the rate of profit as that required in Case 1.) If the actual time path of q were different from this, then the condition of balanced employment could not continue to be satisfied.

The reason for this result is related to an essential and contradictory property of the accumulation process under the assumed condition of a rising organic composition. In particular, as the organic composition rises, the same amount of constant capital employs less labour. Because of the labour thereby released, it is possible to accumulate capital even with a constant labour force, hence without resorting to an external source of labour supply. Thus, accumulation of capital now, in effect, creates its own labour supply through the 'recycling' of existing labour. But, at the same time, with the value of labour power constant, the rate of profit falls, thereby reducing the rate of new investment. The same rate of employment can be maintained under these circumstances only if the increase of the organic composition slows down, coming to a halt at a certain point.[1] Otherwise, if the organic composition continued to increase, this must necessarily create a growing relative overabundance of labour such that the condition of balanced employment cannot continue to be fulfilled.

This result rests on the assumption that the value of labour power remains constant, which incorporates a specific hypothesis concerning wage determination. In the absence of some such specific hypothesis, there is another possible solution for balanced employment. This is through appropriate changes in the value of labour power. Suppose, for example, that q grows at a constant rate, say β, and that the labour force is constant, $n = 0$. Then, for balanced employment with a constant labour force, we have two equations

$$\dot{q} + \dot{v} = a(1 - v)$$

$$\dot{q} = \beta q$$

which have the following solution:

$$q = q_0 e^{\beta t}$$

$$v = 1 + \left(1 - v_0 - \frac{\beta q_0}{a + \beta}\right) e^{-at} - \frac{\beta q_0}{a + \beta} e^{\beta t}$$

As t increases, v declines (after some point), eventually reaching zero at finite t. Here, the decline in v has a two-sided effect which serves to maintain balanced employment. First, it enables the same amount of investment in variable capital to buy more labour. Second,

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[1] If the labour force is constant, then for balanced employment we must have $\dot{q} = a(1 - v_0)$. In this case, the organic composition rises indefinitely but at a rate which diminishes asymptotically to zero ($\dot{q}/q \to 0$ as $q \to \infty$).

it counteracts directly the falling profit rate and thereby keeps up the rate of investment. A decline in v is of course achievable without a decline in the absolute level of the wage. It requires only that wage increases be less than proportional to productivity growth.[1] But in order for v to decline to zero in finite time, it must be either that λ goes to zero or the wage rate itself goes to zero. The former result seems implausible and could be ruled out. The latter would run up against the barrier of a lower limit of the wage.

There is, of course, nothing to guarantee that any of the preceding conditions would hold exactly as required for balanced employment. It would be an accident if they did. It could therefore be that, instead of balanced employment, there exists a chronic tendency to imbalance or disproportionality between growth of employment and supply of labour. In particular, it could be that, owing to a steady increase of q and associated decline in r with constant v, accumulation of capital creates a growing excess of labour so as to expand continually the ratio of the reserve army.[2] However, it seems unlikely that such a process could continue indefinitely if the assumed mechanism of wage adjustment is operative. In particular, as long as the mechanism specified in equation (7) is operative, continued build-up of the reserve army must be considered to exert downward pressure on the wage so as to cause wage increases to fall behind productivity growth. Hence, the value of labour power would tend to fall. This would, in turn, serve to counteract the falling profit rate and correspondingly interrupt the growth of unemployment. If the organic composition of capital continued to increase, a new round of increasing relative unemployment would again be initiated and again with the consequence of depressing real wages relative to productivity. In this way, the actual path of the economy could turn out to be one of oscillatory movements or cycles.

The accumulation process as a whole

From the preceding analysis we may conclude, at best, that the path of accumulation with a rising organic composition of capital and falling rate of profit is fraught with the possibility of recurring interruptions, owing to an immanent tendency for crises of one sort or another to emerge. The accumulation process, under these conditions, is inherently crisis prone. This conclusion would, in turn, provide analytical support for the view that the theory of the falling tendency of the rate of profit is properly to be considered a theory of crisis tendencies in the accumulation process.[3] It provides, on this view, an account of the process which brings on the crisis and the forces which cause it to recur, given the condition of a rise in the organic composition of capital. The preceding analysis outlines a possible basis for the logical consistency of this position. Whether or not this is the only such process that could bring on the crisis, or the permanent cause of crises, would of course have to be seen as an open question, requiring further argument. In particular, a further argument would have to be mounted as to why, if at all, a persistent rise in the organic composition of capital should be considered a necessary and permanent condition of the accumulation process.

However, this is not the position of some who have, at least in recent times, sought to support and defend the theory of a falling tendency of the rate of profit. They have

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[1]Some commentators interpret Marx as arguing that the relative share of wages *declines* as the economy develops. See, for instance, Steindl (1952, p. 230).

[2]This seems to be the situation that Marx envisaged and took to be 'the absolute general law of capitalist accumulation' (*Capital*, I, p. 644). On this, see also Okishio (1972, 1977).

[3]This is the view taken, for instance, by Dobb (1940, pp. 94–106).

opted instead for a distinct alternative position. This latter position is that, *even abstracting from the pattern of recurrent crises*, a falling tendency of the rate of profit is a permanent built-in feature of the process of capitalist development. Hence, it is a matter of the inner logic of capital in general and conforms therefore to a general law of motion of the system.[1] For the purpose of examining the logical consistency of this position, I now present, by means of a diagrammatic exposition, a synthetic construction of the accumulation process as a whole, drawing on the analytical treatment presented above.

For this purpose, it is assumed throughout that the reserve army mechanism operates to counteract any tendency of accumulation to run ahead of or fall behind the growth of the available labour force. Thus, except for transitional adjustments, the economy is held to a line of advance along which a balance between growth of employment and of the labour force is continually reinforced. The wage rate rises (falls) by just enough to ensure that this condition is satisfied. In this strict sense, the analysis abstracts from possible crisis tendencies in the accumulation process. This procedure makes it possible to identify the existence of any law of motion of the system when it is, so to speak, continually attracted to a point which is a (shifting) centre of gravity. For ease of exposition, it is assumed that all profits are invested, so that $a = 1$. Fig. 2 incorporates the relevant relations and Fig. 3 plots the implied time paths of the profit and wage rate.[2]
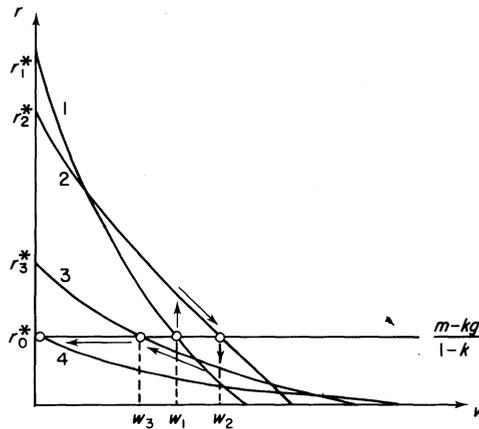

Fig. 2.

Initially, say in Phase I, there exists a single technique of production, technique 1, with maximum profit rate r_1^*. With the given technique of production, accumulation occurs through drawing in labour from outside the system. Given the rate of inflow of labour, the reserve army mechanism holds the wage at the level w_1 and the profit rate at the level r_0 appropriate to the existing conditions of production, accumulation, and labour supply. This situation corresponds to Case 1 discussed above and may be taken to represent an initial phase of the accumulation process.

[1] For statements of this position, see Cogoy (1973), Fine and Harris (1976), Yaffe (1972).

[2] Throughout this analysis, and especially in this section, it is necessary to recall Robinson's correct insistence on the distinction between comparisons of equilibrium and analysis of processes of change. See Robinson (1962, pp. 23–33). In this respect, the simplification of assuming a uniform organic composition is a matter of great convenience enabling us to avoid the analytical difficulties associated with the use of more complex production models with heterogeneous commodities.

There comes a time when the organic composition of capital begins to rise. Evidently, this presupposes emergence of a definite pattern of technical change which itself requires to be explained, but we leave that here as an open question. A new phase begins: call it Phase II. The rising organic composition establishes the conditions of accumulation on a new basis, making it possible to accumulate capital through recycling of existing labour. But we continue to assume, as well, the possibility of drawing on an inflow of new labour at the same rate as before.[1]

The opening of Phase II is marked by introduction of technique 2. The new technique allows a higher rate of profit at the previously existing wage w_1, and a correspondingly higher rate of accumulation. At this rate of accumulation there exists excessive growth of demand for labour relative to the supply made possible both from recycling of existing labour and by inflow of new labour. Consequently, the wage rate is driven up, and the rate of profit falls. The rate of inflow of labour sets a floor to the rate of profit at the previously established level r_0 and, in the absence of new disturbances, a new balance would be possible at this level with a higher wage at w_2. But this position, if notionally achieved, is only transitory. One may imagine a continuing sequence of such transitions as technical change continues (see Fig. 3).[2] Each new technique brings initially a higher
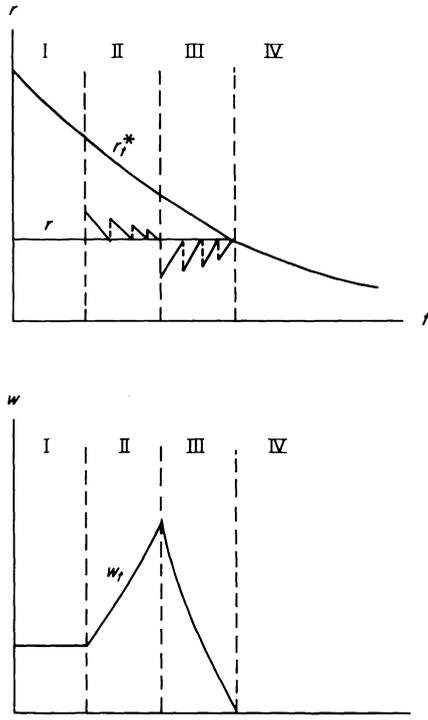

Fig. 3.

[1]The emergence of technical change must also be expected to alter the conditions on which labour is drawn into the system, for instance by altering the basis of competition between capitalist and non-capitalist producers. This would imply a shift in the parameters of labour supply: m, k, and g. However, this complication is suppressed for the sake of simplicity.

[2]In a more complex model of production it would be necessary to take account of the possibility of reswitching of techniques and capital reversal which are ruled out here by the assumption that the organic composition is uniform.

rate of profit relative to the previous level r_0 and, as a consequence of rising wages, the profit rate falls back to the level r_0 given by the growth rate of the labour supply. However, as the organic composition continues to rise (or, equivalently, as the maximum profit rate falls), there must come a point where the introduction of a new technique, instead of raising the profit rate at the existing wage, actually *lowers* the profit rate. This point is shown in Fig. 2 by the introduction of technique 3 coming after technique 2. This immediately begs the question of why technique 3 would ever be introduced at all, since it appears to contradict the underlying conditions of competition and profit maximization. But we leave this question aside for the moment and return to it below.

If and when that point occurs, it marks the beginning of Phase III. If technique 3 is introduced, the rate of profit consistent with that technique at the existing wage w_2 is lower. But the growth rate of labour demand is correspondingly lower and this must be considered to bring about a rise in the relative size of the reserve army, given the displacement of existing employment by the new technique and the continued inflow of labour. Consequently, the wage rate is pushed down to w_3 and the profit rate for technique 3 rises back to the level r_0. Similar transitions may be assumed to occur as technical change continues to raise the organic composition (see Fig. 3). Eventually, the wage rate must fall to zero and correspondingly the profit rate hits up against the maximum.[1] This occurs at the point of introduction of technique 4 which may be considered the start of Phase IV. Beyond that point, it follows trivially that the profit rate falls as the organic composition rises.

It is evident from this construction that, if there exists any tendency for the profit rate to fall in the course of the accumulation process, that tendency is attributable, in the first place, to a rise in the wage. This is the case in Phase I. It is also, in Phase II, an aspect of a transitional movement associated with the introduction of a new technique and results in a new transitory position of balance in which the level of the profit rate is no lower than it was before. Phase III is associated with a reverse tendency for the rate of profit to *rise* due to downward pressure on the wage under conditions of chronic over-expansion of the reserve army of unemployed labour.

In Phase IV a falling tendency of the profit rate exists trivially as the consequence of a rising organic composition of capital at a zero wage. However, this phase would have to be ruled out as economically implausible and irrelevant since it requires a zero wage.

There remains a question whether the transition to Phase III could reasonably be expected to occur. This transition is marked by the introduction of a new technique which is only capable of yielding a lower profit rate than the going rate at the existing wage. That event would have to be ruled out for economic reasons, because it contradicts the underlying conditions of competition and profit maximisation. Specifically, those conditions entail that, with respect to the choice of technique, what is profitable for one capitalist is (eventually) profitable for all, so that *after general adoption of a new technique* the new rate of profit must be at least as great as the previously existing one at the pre-existing wage.[2] Any technique that is less profitable would be eliminated under competitive conditions in this sense. Therefore, by this reasoning, the transition to Phase III would never occur.

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[1] If a (rising) minimum wage is an effective constraint, then the system must be supposed to hit up against that barrier long before this point is reached.

[2] A general proof of this result is contained in the theorem of Okishio (1961). For the simple model used here it may be shown as follows. Let a_0^0 be the amount of labour and a_1^0 the quantity of the homogeneous commodity

Alternatively it might be argued that the presumed condition of competition itself must be given up.[1] The transition to a new phase might then be thought to occur through transformation of the structural properties of the economy, say, from competition to monopoly. This line of argument is suggested by Steindl (1952, pp. 242–243) in an earlier discussion of the falling-profit-rate theory. It follows from this way of viewing the matter that, even though the tendency of a falling profit rate is not actually realised, it exists as a potential which is immanent in the process of increasing organic composition leading up to the transition point and which, furthermore, accounts for the structural transformation that occurs at that point. This would provide a way of rescuing the falling-profit-rate theory, if only as a contingent condition that is specific to a particular phase of the accumulation process. It begs the question, however, of what specific form the process of accumulation would take after the supposed transition occurred and, in particular, what would then be the basis of selection of production methods and of technical change. The problem here becomes one of what is the relevant and appropriate conception of the next phase. If it is to be regarded as a phase of 'monopoly capital', what is the appropriate conception of monopoly capital? This is a deep and far reaching question that goes beyond the scope of this paper.[2]

The organic composition of capital

Throughout the analysis presented here, it is assumed that there exists a tendency for the organic composition of capital to rise over the whole course of the accumulation process. It is taken, so to speak, as a *given* condition of the accumulation process. This is in keeping with a long-standing tradition of Marxian analysis. Even when it is taken on these terms, however, a striking result emerges as shown in the present analysis. This is that the logic of the accumulation process conceived as a whole would be such as to rule out an indefinitely increasing organic composition. Thus, within the terms of this conception of the accumulation process, the idea of an indefinitely increasing organic composition cannot logically be sustained.

[1] Specification of the conditions of competition would require a different level of analysis from that assumed here, one which would allow, in particular, differentiation of production conditions among commodities and firms.
[2] For a discussion of this question in relation to the conception of stages of capitalist development within Marxian theory, see for instance, Wright (1977), Levine (1975). On the specific idea of a stage of 'monopoly capital' see Steindl (1952), Sweezy (1956), Baran and Sweezy (1966).

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directly employed per unit of output with the existing technique. The rate of profit is r and the wage rate w. Then, the price of production is

$$(a_0^0 w + a_1^0)(1 + r_0) = 1$$

For an individual firm, a new technique (a_0^1, a_1^1) is more profitable if it is cost-reducing in the existing price situation, which implies

$$a_0^1 w + a_1^1 \lesseqgtr a_0^0 w + a_1^0 = \frac{1}{1 + r_0}$$

In the new price situation, after general adoption of the new technique, we have

$$(a_0^1 w + a_1^1)(1 + r_1) = 1$$

If follows that

$$\frac{1 + r_1}{1 + r_0} = \frac{a_0^0 w + a_1^0}{a_0^1 w + a_1^1} \geqslant 1$$

so that $r_1 \geq r_0$.

But if the rising tendency of the organic composition is not to be taken as a mere given, or as a kind of 'iron law', it would itself require to be provided with some explicit and systematic motivation. We face here a question of why it should be assumed that this tendency exists at all. In this connection, it would be fair to say that no satisfactory argument has ever been constructed, not even by Marx himself, to show how a rising organic composition in the economy as a whole (as distinct from individual firms or industries) could be deduced from the logic of the accumulation process. In this sense, there exists no theory to support the presumption of such a tendency.

It could be argued, of course, and this is probably close to Marx's own position, that this is a reasonable and correct *empirical* assumption for a specific historical period, that is, the period of 'the transition from *manu*facture to *machino*facture'.[1] In fact, available evidence gives some empirical support for this assumption for a period extending through the late nineteenth and early twentieth century. But evidence for the subsequent period up to the present casts doubt on its continued validity.[2]

It follows that, on empirical grounds at least, a crucial condition underlying the Marxian theory of accumulation must be viewed as having limited significance. Its significance is confined to a particular phase of capitalist development. The problem then becomes one of constructing an alternative basis for a theory of accumulation that would be appropriate to the conditions of modern capitalism.

Conclusion

The analysis presented here indicates that what is fundamentally involved in the controversy regarding the falling rate of profit theory is a question of the existence within Marxian economics of a systematic and plausible account of the capital accumulation process appropriate to the conditions of modern capitalism. Once the specific proposition of a falling tendency of the profit rate has been shown to be either contingent, indeterminate, or simply implausible on its own terms, we are evidently forced to confront this general question head on. As a general question, it has far reaching implications within Marxian theory.

Through the heuristic device of a simple analytical model, the preceding analysis pinpoints three major areas of concern that are of crucial significance and that require further attention in seeking to constitute an adequate theory of accumulation. One such area is the conception of wage determination. Here, the canonical idea which is thrown up often in recent literature is one that rests on the notion of 'class struggle' as a determinant of the real wage. If this is viewed as a wholly external circumstance with respect to the accumulation process, it would make the accumulation process subordinate to a condition that is itself unexplained or, perhaps, inscrutable. If not, it would need to be made compatible with the presumption to be found in Marx's own analysis that the real wage is a dependent variable of the accumulation process. With this latter conception, as we have seen here, the struggle over the wage is systematically mediated by the conditions of production, accumulation, and labour supply. Understanding of that struggle presup-

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[1]This argument has been cogently presented by Sweezy (1972, 1973, 1981).

[2]For discussions of the relevant evidence, see Blaug (1960), Creamer (1954), Deane and Cole (1969), Gillman (1957). Assessment of the empirical evidence is made difficult by the lack of correspondence between the concept of organic composition used in the theory and the available statistical measures.

poses, therefore, a systematic understanding of those conditions. On the other hand, this latter conception, as presented here, suffers from the serious limitation that it makes the real wage fully determined within the labour market. It reflects also a significant point of continuing influence of classical political economy on Marxian analysis.[1] It would seem, then, that this leaves us with two polar extremes for conceiving of wage determination, which are both in their own ways inadequate. A way needs to be found out of this bind, and this calls for further investigation.

The second area of concern is the conception of competition. We confront this issue here in a rather formal way, as a matter of the criterion governing the choice of technique. If the criterion is that of competition in a specific sense, it is shown here that a continuing tendency for the organic composition to rise to a point where it results in a decline in the profit rate below some previously established level would run up against a barrier in that same condition of competition. Therefore, if the condition of competition is to be sustained, the possibility of a fall in the rate of profit must be ruled out. Alternatively, one might argue that it is the supposed condition of competition itself which must be given up, yielding place to an alternative conception such as that of a monopoly phase in the accumulation process. It must be emphasised that this is a substantive and not merely formal problem. It concerns what is the relevant and appropriate conception of both competition and monopoly and their status in the analysis of capitalist development. As such, this problem points to a set of theoretical and historical questions that have for a long time been a major bone of contention within Marxian analysis and still remain unsettled.

The third area of concern appears here, and in much of the literature on the falling rate of profit, in the narrowest terms as a matter of changes in the organic composition of capital. The issue which this raises concerns not so much the concept of the organic composition itself and its measurement, though that has its own problems.[2] What really matters is the underlying conception of the process of technical change by which the organic composition and its movement are supposed to be determined. This points to the need for an appropriate conception of production and the changes in methods of production that take place in the course of development of the economy. Marx's own argument regarding this provides rich insights into the nature of the capitalist organisation of production and the interdependent processes of change in production methods and concentration and centralisation of capital.[3] These are the crucially relevant directions for further investigation.

All of these are interrelated issues. They concern the possibility of conceiving the process of accumulation and development of capital as a total and unified process moving through qualitatively distinct phases as a result of its own inner logic. A framework for that conception was first put forward in a systematic way by Marx. Within the confines of this paper we can do no more than point to some of the crucial issues involved in that conception which still remain to be resolved. A concentrated analytical effort needs to be directed to their solution if the Marxian project is to be realised.

[1] The presumption that the real wage is determined within the labour market is typically 'classical'. It was undermined by the Keynesian argument that the labour market can be considered to determine directly only the money wage and not the real wage. On this see Robinson (1947, ch. 10), Steindl (1952, pp. 236–239).

[2] See, for instance, Robinson (1978), Schefold (1976), Gillman (1957).

[3] *Capital*, I, parts IV and VII. See also Rosenberg (1974, 1976), Sweezy (1972, pp. 127–146), Braverman (1974).

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