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Technical Change and the Contradictions of Capitalism

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INTRODUCTION: THE ISSUES

Capitalist society exists *in history;* it is a social organism with a "lifeline," in the palm-reading sense; a path of development from infancy and youth, through maturity, to old age, and eventual replacement by higher forms of social organization. A central task of Marxist theory is therefore to determine the nature of capitalism's historical limits; its aging process, the way its contradictions mature and deepen.

All societies begin with a set of production activities, in which people interact with nature to extract their means of existence. Development of the *productive forces* — the power to draw upon and transform the natural environment — is a crucial part of a society's maturation path. In tracing the lifeline of capitalist society, then, technical change — transformation of the labor process, from the industrial revolution and the rise of "machinofacture" to the present-day electronics revolution — plays a prominent role. Marxists have sought to understand the forces propelling changes in production techniques; their social character and impact, both in the workplace and in society at large; and their general trend of development. The relation of technical change to the class structure of society is surely of major importance here; as is its relation to the *rate of profit* — the most general indicator of the efficiency of the capitalist economy in its own terms — since this is the root of long-term, or general, crisis.

This chapter is not a systematic introduction to these concepts in the classical Marxist texts; to develop Marx's argument in its own terms would mean a lengthy presentation of his special vocabulary and definitions, which will not be attempted here. Nor will I present a survey of contemporary Marxist theories and their criticism. Rather, I hope to discuss the main issues informally, and in language which is as self-evident and accessible as possible. I have kept the text clear of references; a bibliographical appendix covers the main source literature.

HISTORY, SOCIETY, AND TECHNICAL CHANGE

That capitalists urgently and continually revolutionize techniques of production is hardly a matter of dispute. Somewhat more controversial are Marx's claims concerning "concentration and centralization" of capital (fewer and larger units of capital, as small fish get eaten by the big ones), and polarization in the class structure (the middle strata are depleted and the working class recruited).

There have been several attempts to portray the evolution of capitalist societies in terms of stages, drawn from historical experience. The most common of these posits a transition from a liberal stage to a late-capitalist, or state-monopoly-capitalist, stage. Some recent work has elaborated on the concept of stages, by designating periods in the

relation between classes as "social structures of accumulation." We must ask, however, whether the stages conception amounts to more than a descriptive account of historical events. How many stages are there? Is there a progressive sequence of stages, and if so, on what is it based? These questions point to one issue: the stages as segments of the lifeline of a single social system; capitalism. To show that the stages share a common *process of development,* we must identify aspects of capitalist accumulation that are *not unique to each stage*. Put simply, I believe that one unifying thread is capitalism's unique shaping of technical change.

Technology, and technical change, mirror the society which produces them; they are not the result of some neutral, pre-existing "nature" or "march of science." The question, however, remains: have we been able to present technical change in a capitalist economy as a dynamic process, with a determinate direction? Is it enough to refer merely to rising labor productivity? Arguments can indeed be made that rising productivity, and factors that eventually cause the growth rate of productivity to decline, are important elements in the theory of capitalist crisis. To do justice to this line of thought, however, we need to grasp not just productivity growth, but also changes in the structure of production; the relation of investment in physical capital to the quantity of labor in production. The concept of a *bias* of technical change,[1] stemming from the choice of technical changes by individual capitalists pursuing their goals within a specifically capitalist framework, has important implications for long-term crisis — the length of capitalism's lifeline.

THE BIAS OF TECHNICAL CHANGE: THE CLASSICAL ARGUMENT

To set the stage for the discussion to follow, we will need a few simple definitions. We want to think about an industrial capitalist economy, in which fixed capital is the most prominent part of a capitalist's investment; for the sake of simplicity, then, we ignore raw materials and the part of fixed capital that depreciates in each period. Production is represented by a stock of fixed capital (the non-human inputs, machinery, plant, etc.), a flow of current labor, and a flow of output. ("Flows" are measured by a period of time, per year, per week, etc.) The usual problems arise when we try to think about how these stocks and flows are measured; imagine either an all-purpose commodity with a straightforward natural unit of measurement, or some sort of "constant dollar" index.

The argument proceeds in terms of two concepts, each of which is a relation between a flow and the stock of fixed capital. We define the *output ratio* as the ratio of *output* to fixed capital, or output per unit of fixed capital.[2] Output is divided between the two classes, workers and capitalists (we ignore intermediate strata, government, etc. for present purposes); it is therefore wages plus profits. Our second major concept is the *rate of profit,* defined as the ratio of *profit* to fixed capital, or profit per unit of fixed capital. Notice that, if wages were zero, output and profits would be the same. The output ratio is therefore the maximum possible rate of profit.

We can now locate the classical argument: in a capitalist economy, the *output ratio has an inherent tendency to fall*. Why? Begin with casual observation: in the eighteenth century, a score or so of workers may have worked together in a "manufactory," with simple tools inherited from the artisan tradition, and a minimum of machinery and equipment. By contrast, the nineteenth century may be represented by the steam-driven machinery of England's textile industry, with thousands of workers in factories, and

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Marx's argument is buttressed by observations concerning class conflict, and in particular the use of machinery as a weapon against workers in the class struggle. Machines do not demand higher wages in a tight labor market, nor go on strike, nor demand coffee breaks, changes in work rules, etc. Moreover, the combined efforts of capitalists to replace workers with machines may cause the pool of unemployed workers to swell, and this may have the desired (from the capitalist viewpoint) effect of driving down the wages of the employed.

The implications of a tendency for the output ratio to fall can now be outlined. If the *maximum* rate of profit is falling, sooner or later the *actual* rate, lying between a floor of zero and a collapsing ceiling, must also turn downward. (The only way this could be postponed is by a rise in the *share of profits in output,* which might temporarily offset the fall in output per unit of capital.) If the rate of profit, in turn, is falling, then the rate of growth sooner or later must turn downward. This is why capitalism's contradictions might get worse over time; why its lifeline is finite in length.[3] In many ways, the rate of profit has long seemed to be the central concept, being simultaneously the capitalists' own strategic target and the main indicator of the power of capital to do what it must do to survive — namely, expand. Marx's "law of the falling tendency of the rate of profit," therefore, has figured prominently in discussions of long-term crisis.

THE COUNTER-CRITIQUE

Attentive readers may already have seen some holes in the foregoing argument. We will now examine them, beginning with the falling output ratio.

We can see more clearly what is happening here if we write this ratio in a slightly fuller form:

$$\frac{\text{output}}{\text{capital}} = \frac{\text{output/labor}}{\text{capital/labor}}$$

In this form we can see that the output ratio is a ratio of ratios, with output per unit of labor, or *labor productivity,* in the numerator, and fixed capital per unit of labor in the denominator. Clearly, the output ratio will fall if, and only if, productivity (which is clearly rising) rises *more slowly* than the physical capital/labor ratio (which is also clearly rising). The capital/labor ratio is an index of the degree of mechanization, and Marx's arguments concerning the use of mechanization as a weapon against workers certainly supports the view that it rises over time, as does the casual evidence referred to above. The question, however, is whether the capital/labor ratio rises more rapidly than productivity, in general. Productivity is also stimulated by the capitalist search for higher profits and for weapons to fight each other with, as well as for use as the "battering ram" breaking down barriers to capitalist penetration around the world. There seems to be no reason why the denominator should necessarily rise more rapidly than the numerator; the whole trend is therefore called into question.

However, even if we assume that new techniques have come into existence with a lower output ratio than those in common use — and that workers are able to resist a rise in

the profit share, so that no offset takes place — a further, and seemingly devastating, question must be answered: Why would capitalists, who are perpetually in search of higher profit rates, willingly introduce techniques which result in a lowered rate of profit? And, assuming they have done so out of the inability to read the situation correctly, once they discover that profit rates have fallen with the introduction of the new technique, won't they go back to the old techniques, which yielded higher rates of return? This question seems to put an end, once and for all, to speculation about any long-term tendency of the profit rate to fall stemming from technical change. Moreover, it focuses attention on an important requirement for any theory tracing a connection between technical change and a falling rate of profit (or between anything and anything else, for that matter); it must be based clearly on the assumption of rational behavior on the part of individual capitalists.

Some contemporary Marxist economists, notably Nobuo Okishio, have called attention to the relationship between individual and crowd in capitalist competition, which provides an answer to the question: How can the rate of profit which matters for the choice of technique differ from the one which eventually materializes?

To understand the Okishio Theorem, imagine a capitalist economy composed of numerous sectors, each sector producing one sort of good. Conditions are competitive, in the sense that capitalists can move their capital freely from one sector to another; therefore, the rate of profit has come to be the same in every sector, and prices of inputs and outputs have adjusted accordingly. Now focus on one sector, and notice that it is composed of many individual firms. Finally, consider just one of those firms, the place where decisions about technical change are made.

An engineer runs into the firm's head office with blueprints for a new technique. The question is, should the firm adopt it? It involves different inputs of machinery and raw materials, and different amounts of some sorts of materials (we ignore for the present the fact that new techniques usually mean entirely new *types* of inputs and outputs).

The firm will "cost up" the new technique: find the relationship between expected revenue from sale of the good and the cost of producing it, and therefore the expected rate of profit. And it does this assuming that it is the *innovator* of this new method, installing it first, before any competitors, either already in the industry or potentially in it, have had a chance to copy it. In these conditions, since the firm is one of many producing the good, the prices of inputs and outputs will not be affected by the firm's decision. The firm is therefore calculating a very special "innovator's" rate of profit, and it will not decide to install the new technique unless this special rate of profit is higher than the prevailing one.

Now suppose the innovator's profit rate is indeed higher. The firm knows quite well that, once word gets around, its competitors will not sit still and let it lap up these special profits forever. When everyone gets into the act, all sorts of things start to happen. Prices of inputs and outputs in the industry are affected (the market notices large changes of this kind); presumably, many capitals enter the industry, since it has a higher-than-average rate of profit, and the price of the good produced by this industry will fall. All of these price changes upset the delicate balance of input and output prices in all industries (not just the one where the madness began!). The final outcome must be a readjustment of all prices, so that eventually a new balance emerges, in which all industries are once again earning the same rate of profit. Like the old man in Hemingway's *Old Man and the Sea*, the innovating firm does not get to keep the results of its innovation, but must share it

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Now we come to the key question: Is the new, balanced profit rate higher than, lower than, or the same as, the original one? To answer this question, Okishio makes a crucial assumption: through all the turmoil of the transition brought about by the change in technique in the one industry, the real wages of the workers have remained constant. And on this assumption, the Okishio Theorem can be stated: if the new technique yielded innovator's profits higher than the old balanced rate, then the new balanced rate must also be higher.

In summary: First, Marx never backed up his assertion that the output ratio would fall. Second, he never clearly answered the question: Why would capitalists ever willingly lower the profit rate? And third, even when we introduce the innovator/rebalancing dynamics, the result is that rational capitalists will never act so as to bring about a falling rate of profit.[4] Whatever criticisms we may have of approaches to crisis theory that rely on *ad hoc* stages, or that explain falling profits as resulting from class struggle (but how are the strengths of the conflicting classes to be explained?), or from shortfalls of demand (and no one has yet produced a satisfactory long-term version of this approach, in my view), we still seem to be at a dead end in attempting to relate long-term trends to capitalism-specific peculiarities of technical change.

A THEORY OF ENDOGENOUS, AND MAYBE BIASED, TECHNICAL CHANGE

In the Okishio approach, although a new technique is subjected to a sophisticated innovator's analysis, it still seems simply to fall from the sky, rather than being "endogenous"; conditioned by the capitalist social structure.

Imagine a firm in an industry in a competitive capitalist economy, in which there has emerged a uniform rate of profit of 10 percent. The firm is also, of course, earning exactly 10 percent, on a capital stock of 200. We assume the output ratio is 50 percent, so the production process generates an output of 100, of which 20 (10 percent of 200) is profits, and the remaining 80 goes to wages. (This profit share of 20 percent is undoubtedly unrealistically low; the numbers, however, have been chosen for easy calculation, not for correspondence with the real world.)

As before, an engineer runs in with a new technique and messes everything up. She/he proposes raising output by 10 percent, to 110; but this can only be done if mechanization increases the capital stock by 20 percent, to 240. From the standpoint of the innovator, the wage remains 80; it is determined by general conditions in the industry and the economy, and will not be affected by this particular innovation. That leaves 30 (110–80) for profits, forming an innovator's profit rate of 30/240, or 12.5 percent. This is two-and-one-half percentage points above the norm! We again assume that, in the intensely competitive conditions which prevail, the firm will have no choice but to install the new technique: those temporary innovator's profits are the key to growth and survival. Notice that this will be done even though the output ratio falls to 110/240, or about 46 percent.

The new technique now spreads to the industry as a whole. Here the beginning of wisdom is that technical change disrupts all existing norms: work rules, output norms for piece rates, managerial hierarchies, wage scales, all must be re-established, either through negotiation, or by means of more informal methods of class conflict. In our simple example, the only item which can be treated explicitly is wage scales. Productivity has gone up by 10 percent. The question is, what will happen to wages?

One answer, of course, is that given by Okishio: nothing. If the wage stays constant at 80, the rate of profit will remain 12.5 percent after the new technique is introduced; this illustrates Okishio's proposition that the rate of profit can not fall as a result of technical change. Notice, however, that in this case, in which capitalists reap all the benefits of technical change, the *profit share has risen,* from 20 percent to about 27 percent.

But this is not the only possible answer. First, in competitive conditions, the price of the product may fall as productivity rises. With given *money* wages, this would mean a rise in *real* wages; in fact, they would rise by the same percentage as productivity, 10 percent. Indeed, if we think of the profit share of output as the most appropriate measure of the balance of class forces in the conflict between labor and capital, then — assuming that the technical change has not altered this balance significantly — the profit *share* will remain constant. In this case, wages will rise by 10 percent, to 88. Profits will then be 110–88, or 22. The profit share is the same as before the innovation, 22/110, or 20 percent; the profit *rate*, however, has now *fallen* to 22/240, or 9.1666 percent. It should be clear that, with a falling output ratio and a constant profit share, the profit rate must fall. Remember also that the firm *must* innovate, and the imitators *must* imitate, even if their experience suggests that real wages will eventually catch up with productivity. Anticipating the fall in the profit rate from 10 percent to 9⅙ percent, capitalists will still have no choice but to proceed with the new technique.

Of course, the eventual effect on the rate of profit depends not only on the nature of the new technique, but also on the social, class process set in motion by the technical change. It should be emphasized, however, that this is just as true of the constant-real-wage case as it is of the constant-relative-shares case. For the real wage to remain constant in the face of rising productivity and profits, the capitalists must have gone on a rampage! You will imagine, and I think correctly, that the actual situation may well lie somewhere between the two extremes. What emerges as a general rule *in the case of a falling output ratio* is that *either* the profit share must rise *or* the profit rate must fall, *or* both. If a falling *rate* of profit affects the capitalist lifeline in one way, and a rising *share* or profit affects it in another, then we may focus on the most important issue: why did the new technique involve a falling output ratio? This is the underlying source of the critical tendency, and we are still simply postulating this change, rather than explaining it. After all, if the new technique had shown a constant or rising output ratio, then a constant or rising profit rate would have been compatible with a constant or falling profit share. It is the existence and superiority of new techniques which lower the output ratio that must be established.

But before turning to that issue, consider the question, raised above, concerning reversibility of technical change. If the profit rate has fallen — as in our constant-shares case — why then will capitalists not revert to the old technique? Consider what would happen if some hapless (and no doubt soon-to-be extinct) capitalist were to return to a capital stock of 200 and an output of 100, after the new technique has been generalized, and wages have risen to 88. That would leave a profit of 12, for a profit rate of 12/200 or 6

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percent! This is in fact the rate that would accrue to any firms which failed to make the original transition between techniques, showing why firms will *jump* to install new techniques that lower their rate of profit from 10 percent to 9⅙ percent! If a falling-rate-of-profit process is in place, then it is not reversible.

The question remains: why were we allowed to assume that the new technique had a lower output ratio than the old one? The answer is that we weren't — necessarily! But to see what is involved, let's assume that our engineer does not simply discover a single new technique in the laboratory, but rather can propose research on a range of new techniques, with different increases in mechanization and productivity.

The engineer can bring about productivity increases, but not, of course, infinite ones. Each time you ask her/him to add (say) another five percentage points to the increase in productivity, the "cost" in terms of additional capital stocks will be greater. For example: to achieve an initial 5 percent rise in productivity, it may only be necessary to increase the capital stock by 4 percent. (This would mean a rising output ratio.) But adding another five percentage points in productivity (a 10 percent rise overall) will require a further *16* percentage points of capital-stock increase, for a total of 20 percent. (This is the case used in the example above.) It might even be possible, within a "short period" time frame, to raise productivity by still another 5 points, to 15 percent; but this, according to our assumptions, might require a 30-point additional increase in the capital stock (a 50 percent overall rise). The terms of this trade-off will undoubtedly reflect capitalist social structures as much as any kind of "pure" natural or technological factors.

The situation can be summed up as follows:

new technique	change in output	change in capital stock	innovator's profit rate	new balanced profit rate
A	5%	4%	12.019%	10.096%
B	10%	20%	12.500%	9.166%
C	15%	50%	11.666%	7.666%

If techniques A, B and C were indeed the only choices available, it would clearly be most beneficial from a social standpoint to adopt technique A, since it yields a higher return than the prevailing 10 percent — although, to be sure, not by much! (There is much more to the complex issue of social criteria for choice of technique, but we will not pursue the matter here.) The choice for the individual capitalist is equally clear, and different: it is technique B, with the highest innovator's rate of 12.5 percent. The figures for the new balanced profit rate assume a constant profit share of 20 percent and technique B, as we have seen before, produces a fall in that rate to 9.1666 percent.

How likely is it that the technique which yields the highest innovator's profit rate (B in the example) is also one which lowers the output ratio? Is it possible that a technique like A might be the one that looks best to the innovating capitalist? It is hard to give a precise answer, without developing a more formal model (see the bibliographical appendix). But we can do one more little experiment. Suppose the profit share had been 30 percent instead of 20 percent; this makes the original profit rate 15 percent instead of 10 percent. Now if we re-examine techniques A and B, we will find that the innovator's profit rate in A is 16.827 percent; compared with 16.666 percent for B; and that the new balanced rate

is 15.144 percent for A, compared with 13.75 percent for B. So the technique that raises the output ratio (technique A) also has the highest innovator's profit rate *and* the highest actual rate; the divergence between private and social interest that resulted in the falling profit rate tendency is eliminated. We can conclude that a high wage share (low profit share) is conducive to the falling-profit-rate tendency, and vice versa. For a given income distribution, however, the matter turns on the extent to which productivity increases can be obtained without mechanizing, and the rate at which diminishing returns to mechanization set in. The less the resources a society can devote to fundamental science, and the more *slowly* diminishing returns set in (owing perhaps to an engineering culture based on a long-established search for high innovator's profits), the more likely it is that the path of technical change will be biased, in the sense of showing a falling output ratio. While this issue needs much more study, it points in (what I think is) the right direction: the relation between capitalist economic structures in general and the institutions concerned with the actual production of technical change — the funding of scientific research and the setting of priorities for it, the types of signals received by the engineering community, the time horizon of competitive capitalists and its effect on the rate of dissemination of new techniques; etc., etc.

CONCLUSION: TECHNICAL CHANGE AND CRISIS

We are really just at the beginning of the story. Suppose we have a presumption that capitalist economies exhibit a long-term bias toward a falling output ratio. That, of course, is itself an example of the fettering of progress by a system of social organization, since a rising output ratio, if anything, would be desirable. But the falling output ratio has another important implication, which we have already explored: it implies that at least one of two great macro tendencies — falling rate of profit; rising profit share (rate of exploitation) — must be operative. The falling rate of profit implies an eventually falling rate of growth, with attendant crises of finance, technological shake-out, expectations, competition with socialist planned economies, and much else that needs to be spelled out. The rising profit share, in turn, is associated with pervasive problems of effective demand: with a falling relative wage, the base of total demand is narrowed, and under these circumstances it will be increasingly difficult for investment demand, which must ultimately be based on anticipation of strong demand for consumer goods, to take up the slack.

It should be noted that, if the profit share rises over time (as in fact happens in a full model of capitalist growth based on the theory of technical change described in this paper, as well as in at least some versions of capitalist reality), the bias toward a falling output ratio will weaken over time, and the economy may tend toward steady growth at a low but no-longer-falling profit rate. The importance of the falling profit rate tendency, then, depends on whether the system will run up against a minimum-profit-rate barrier while biased technical change is still operative. Elaboration of a theory of this "financial" barrier, and of the related "stagnation" barrier (a maximum profit share) is beyond the scope of this paper; it would amount to a precise statement of the conditions in which the cyclical crises associated with a falling profit rate and a rising profit share, respectively, become permanent and "nonreproductive." Contact with the barriers, in turn, should be seen as the basis of the need for *structural transformation*, perhaps transition to a new regime or "social structure" of accumulation. The crisis of the 1930s surely propelled a

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it for A, compared with 13.75 percent for B. So the technique that raises (technique A) also has the highest innovator's profit rate *and* the highest livergence between private and social interest that resulted in the falling ncy is eliminated. We can conclude that a high wage share (low profit ive to the falling-profit-rate tendency, and vice versa. For a given income vever, the matter turns on the extent to which productivity increases can iout mechanizing, and the rate at which diminishing returns to mecha- The less the resources a society can devote to fundamental science, and diminishing returns set in (owing perhaps to an engineering culture based ished search for high innovator's profits), the more likely it is that the l change will be biased, in the sense of showing a falling output ratio. needs much more study, it points in (what I think is) the right direction: veen capitalist economic structures in general and the institutions con- actual production of technical change — the funding of scientific setting of priorities for it, the types of signals received by the engineer- the time horizon of competitive capitalists and its effect on the rate of new techniques; etc., etc.

NCLUSION: TECHNICAL CHANGE AND CRISIS

just at the beginning of the story. Suppose we have a presumption that nies exhibit a long-term bias toward a falling output ratio. That, of n example of the fettering of progress by a system of social organization, put ratio, if anything, would be desirable. But the falling output ratio has it implication, which we have already explored: it implies that at least macro tendencies — falling rate of profit; rising profit share (rate of nust be operative. The falling rate of profit implies an eventually falling vith attendant crises of finance, technological shake-out, expectations, socialist planned economies, and much else that needs to be spelled rofit share, in turn, is associated with pervasive problems of effective alling relative wage, the base of total demand is narrowed, and under es it will be increasingly difficult for investment demand, which must ed on anticipation of strong demand for consumer goods, to take up the

ted that, if the profit share rises over time (as in fact happens in a full st growth based on the theory of technical change described in this in at least some versions of capitalist reality), the bias toward a falling veaken over time, and the economy may tend toward steady growth at a -falling profit rate. The importance of the falling profit rate tendency, whether the system will run up against a minimum-profit-rate barrier nical change is still operative. Elaboration of a theory of this "finan- of the related "stagnation" barrier (a maximum profit share) is beyond aper; it would amount to a precise statement of the conditions in which associated with a falling profit rate and a rising profit share, respective- nent and "nonreproductive." Contact with the barriers, in turn, should is of the need for *structural transformation*, perhaps transition to a new structure" of accumulation. The crisis of the 1930s surely propelled a transition of this kind, to a new stage in which the state takes on a new direct role: it helps raise the maximum profit share (the stagnation barrier) by evolving, under pressure from workers, new institutional forms of support (the "social wage"); and lower the minimum profit rate (the financial barrier) by means of subsidies to research and development, guarantees in financial markets, allowing the private sector to exploit nationalized industries through its terms of trade with those industries, etc. Government spending and taxation nevertheless lower the *after-tax* profit rate, constituting a second source of intensifying contradiction, along with biased technical change.

It is tempting to think of the current crisis as a crisis of this new regime of accumulation, with the new barriers again threatening to become effective. This approach places our thinking about the present complex situation of late capitalist society into continuity with Marx's falling-rate-of-profit approach, without making the latter into a fetish or ignoring the obvious difficulties with its earlier formulations.

The theory of biased technical change therefore serves as a "unified field theory" bringing together the several strands in traditional Marxist theorizing about crisis. It establishes the relevance, if not necessarily the ever-present reality, of a falling-profit-rate tendency, but does this without excluding analysis of problems of demand and realization of profits, nor of the changing balance of class power in the labor (and other) markets. Finally, to the extent that a path of technical change can be defined, and in a way that is relevant for crisis theory, the foundation is laid for a unified vision of the stages through which capitalist accumulation passes.

This is one element, but I believe a necessary one, in the continuing study of capitalism's lifeline. It helps us to look at the system's palm, so to speak, and see more than wrinkles, (working-class) calluses, and (capitalist) diamond rings.

APPENDIX
AN INTRODUCTORY BIBLIOGRAPHY

History, Society and Technical Change. For the classical twentieth-century Marxist theory of stages, see Pevzner (1984), Fairley (1980), and, with variations, Baran and Sweezy (1966). For samples of the more recent "social structures of accumulation" approach; Gordon, Edwards and Reich (1981), Edwards, Reich and Weisskopf (1986, esp. Chap. 2). The classical text for the social determination of technical change is, of course, Marx (1967, especially Chap. 10, "Machinery and Modern Industry," and Chaps. 24 and 25, on the trend in the "organic composition of capital"). For more recent discussions, see Braverman (1974) and Levidow and Young (1981).

The Bias of Technical Change: The Classical Argument. In addition to *Capital*, Vol. I, cited just above, the source discussion for this section is Marx (1967, Vol. III, Part III). Arguments which defend and develop the classical theory, although not necessarily in the same way as I have done in the text, will be found in Fine and Harris (1979), Mage (1963), Rosdolsky (1977: Chap. 26); Shaikh (1978) and Weeks (1982).

The Counter-Critique. Critical works on the Marxian theory are legion; I will mention Sweezy (1942), Robinson (1942), Gottheil (1966: Chap. 8), Blaug (1968), Steedman (1977), and van Parijs (1980). For the original statement of the Okishio theorem, Okishio (1961) and for elaborations and extensions, Roemer (1978). On demand-oriented crises originating in a rising profit share, Baran and Sweezy (1966), Foster (1982). The "class struggle" centered view of crisis may be represented by Glyn and Sutcliffe (1972) and Itoh (1978).

A Theory of Endogenous, and Maybe Biased, Technical Change. Since this section contains my own approach, I may be permitted to cite a few papers in which these ideas are developed more fully; Laibman (1977; 1981; 1982; 1983; forthcoming).

NOTES

1. By "bias," I mean a systematic (non-random) change in the proportion of input to output. A "capital-using" bias is equivalent to a fall in the output ratio, defined immediately below.
2. Some readers may wish to link the argument of this paper to those which are expressed in terms of traditional Marxist categories. To start them off, I will note that the output ratio = Y/K, where Y is output, and K is the capital stock. This, in turn, is equal to L/(L/Y)K. L/Y may be thought of as the value of a unit of output, where value is measured in terms of labor time. (L/Y)K is therefore the value (in labor time) of the capital stock. The ratio Y/K, then, is formally identical to $(v+s)/C$, where $v+s$ is the flow of current labor time, in standard Marxian notation, and C is the stock of constant capital (also in terms of labor time). For reasons which I develop elsewhere, I believe Marx's organic composition of capital is best represented by the formula $C/(v+s)$. My output ratio is thus the reciprocal of Marx's organic composition of capital, and my discussion of the trend in the output ratio parallels the traditional formulation in terms of the organic composition of capital.
3. This passage may be clearer to some readers if rendered in symbols. The rate of profit is $P/K = (P/Y)(Y/K)$. If P/Y were = 1, then clearly P/K = Y/K. If Y/K falls, then P/K falls, unless P/Y rises in an offsetting manner. Now the growth rate of the capital stock may be written as investment over the capital stock: I/K. $I/K = (I/P)(P/K)$. From this, we read off that the rate of growth will fall if the rate of profit falls, unless the share of investment (accumulation) in profit rises sufficiently to offset that fall.
4. Criticisms of the Okishio Theorem have focused on the fact that his argument is conducted in terms of transitions between equilibria, and that "equilibrium" in any sense is a violation of Marx's conception of capitalism. There have also been efforts to replace the innovator's, or "transitional," rate of profit with some other target; or to argue that capitalists have systematically distorted expectations. I believe that these counter-arguments do not hit their mark. Equilibrium conditions are used as analytical tools by all great economists, including Marx, and this has nothing to do with the idealization known as "perfectly competitive equilibrium" in neoclassical economics. Also, and for reasons that cannot be fully elaborated here, I believe that the rate of profit, and for purposes of technical change-choices the innovator's rate of profit, remain the most basic and important measure of the power of capital, and the target of capitalist activity, as the business literature widely attests. Finally, the theory of capitalist crisis would only be weakened by allowing it to rest on any view other than one of rationality of expectations, in the sense that capitalists, sizing up their interests from the standpoint of the unique and historically transient position which they occupy in the class structure, are able to draw conclusions from past experience and act accordingly. The interested reader may follow up the arguments on all sides as cited in the bibliographical appendix to this paper.

5

Power, Accumulation, and Cris The Rise and Demise of the Postv Social Structure of Accumulati

DAVID M. GORDON, THOMAS E. WEISSKOPF, and SAM

INTRODUCTION

Crisis may occur in capitalist economies because the capitalist c because it is "too weak."[1]

When the capitalist class is "too strong" it shifts the income d reducing the ratio of working class consumption to national inc economy prone to crises of underconsumption or — in more cor terms — a failure of aggregate demand. When the capitalist cla working class or other claimants on income reduce the rate of expl profit rate and reducing the level of investment (perhaps by indu greener pastures elsewhere).

Karl Marx referred to the first as a crisis in the realization of second as a crisis in the production of surplus value. They may (respectively) as "demand-side" and "supply-side" crises. The ultimately the same — a decline in the rate of profit, a redu investment, a stalled accumulation process, and a stagnation or growth of both demand and output. Thus what begins as a c production, for example, sooner or later turns into a crisis in surp

Some United States historians have argued that the Great Depre a demand-side crisis, brought about in part by the political and ec working class in the post-World War I era. The most recent crisi economy, in contrast, appears to have originated as a supply-side c the erosion of the hegemony of the United States capitalist class i system and by effective challenges to capitalist prerogatives mo citizens during the 1960s and early 1970s. Once and only after thes surplus-value production had initially reduced corporate profitab investment and political efforts to roll back these challenges res problems as well, further reinforcing the dynamic of crisis (I Weisskopf 1983, 1986).

We elaborate this Marxian "supply-side" interpretation in this e stagflation of the last nearly two decades in the United States ca general crisis of the legitimacy and stability of the postwar capital

*The authors' names are ordered randomly.