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A POST-MORTEM ON THE NEOCLASSICAL 'PARABLE'

by

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### 1. Introduction

Recent controversies in capital theory have centered around a number of related issues concerning, for instance, the meaning and measurement of "capital," the problem of "reswitching" of techniques of production and "capital reversal," the significance, if any, to be attached to the neoclassical propositions that the equilibrium rate of profits in a capitalist economy is equal to the "social rate of return to saving" or equal to the "marginal product of capital."<sup>1</sup> Some of those standing on the sidelines tend to dismiss this whole debate as a matter of meaningless formalism. Indeed, the terms on which the debate is conducted sometimes appear to be rather like that of medieval scholastic discussions concerning the number of angels that could stand on the head of a pin. But to dismiss the substance of the recent debate as a meaningless matter would be a serious mistake. Underlying it are deep and far-reaching issues in economic theory going back in time to the Classical economists and which have reappeared from time to time in different forms.<sup>2</sup>

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<sup>1</sup>For a review of these controversies, see Harcourt [1972], Robinson [1970], Bhaduri [1969], Dobb [1970].

<sup>2</sup>As examples of these different forms reference might be made to the Hayek-Knight debate during the 1930's, Wicksell's struggle with the concept of an "average period of production," the nineteenth-century controversies on the problem of "maintaining capital intact," and Bohm-Bawerk's attack on what he called the "naive" and "motivated" productivity theories of interest. A relevant example from the work of the classical economists is Ricardo's problem of an "invariable standard of value" and from Marxian economics the so-called "transformation problem." In the light of this long record of intense debate, it can be seen that the recent controversy is not at all new in substance. The practice of referring to it as a "Cambridge controversy" appears to reduce the substance of the debate to a matter of geography and personality.

The central theoretical problem which lies at the root of these debates has two sides, one qualitative, the other quantitative. On the qualitative side is the question of what is the nature and origin of profits in a capitalist economy. On the quantitative side is the question of what determines the relative shares of profits and wages (or of capitalists and workers) in the net product and hence the magnitude of the overall rate of profits. These two sides are quite clearly interlinked, though in any particular set of answers to the quantitative question the links with the qualitative side may not be made explicit nor be sharply drawn. There is nevertheless within any theory of distribution, qua theory, a fairly well defined set of answers to both of these questions, those answers being quite different as between one theory and another.

In the history of economic thought there have been two major and opposing sets of answers to these questions. One conceives of profits (as well as interest and rent) as a surplus originating in production, that is, as a difference between the output produced and the "necessary costs" of maintaining the laborers during the production period and replacing the worn out means of production. This difference accrues to the owners of property on account of their monopoly of ownership of the means of production. The other conceives of profits as the return to a "factor" of production, imputed to the "services" of that factor in accordance with the relative scarcity of the factor and the technology governing its use. The former conception is found in the work of the Classical economists (chiefly Ricardo) and in Marxian theory. An earlier version, as applied specifically to agricultural production, is found also in the work of the

Physiocrats. The latter conception is found in neoclassical theory as developed by Jevons, Walras, Wicksell, J. B. Clark, among others. The debate regarding these two conceptions and the opposing elements involved in them emerge rather sharply in the work of Bohm-Bawerk [1959].

Tied in with these different conceptions are different views on the nature and meaning of capital as a category in the analysis of capitalist production. In the neoclassical view, the concept of capital is tied to the use of "round-about methods of production" and the associated passage of time between application of physically specified inputs (capital goods and labor) and the subsequent flow of output. Since such methods of production enhance the productivity of a given quantity of labor (otherwise those methods would never be adopted) it is possible to seek to attribute the extra output to the quantity of the extra inputs (which may be only the extra time spent in using the round-about method). This difference in output, in this view, constitutes the return to "capital" as a factor of production or, in a related view, the "reward of waiting" (Marshall).

The Classical and Marxian theories take as given the fact that there are round-about methods which enhance the productivity of labor. The existence of such methods is regarded as part of the description of the technical conditions of production in any society. Beyond this, and as an essential condition of capitalist society, capital is conceived to be a property relation, a sum of exchangeable value tied up in means of production, the ownership of which enables the capitalist to employ propertyless laborers in production and reap the difference between the net product and the amount

paid out as wages. The clearest case of this conception is that of the simplest type of agricultural production, say, corn production, where the capitalist farmer "advances" the corn requirements of the laborer for subsistence (the "wages fund"), the laborer being unable in his propertyless state to provide this for himself, and reaps the difference (excluding rent, which the capitalist pays to the landlord, and interest on borrowed finance) at the end of the harvest.

The recurrence of the debate on these questions at this time reflects the fact that the internal contradictions in the neoclassical theory had never been effectively resolved, despite its considerable elaboration in the interim into a complex formal system. In other words, it reflects the fact that there continued to be inherent logical weaknesses in certain aspects of the neoclassical approach to the problem. One of these aspects, the one which has been seized upon in the recent debate, involves the application of the marginal productivity theory of pricing of factors (or of the services of such factors) to the quantitative problem of explaining aggregate income distribution (so-called "factor-shares") in a capitalist economy.<sup>1</sup> It is in the specific form of the marginal productivity theory that the conception of different factor returns as reflecting relative factor scarcities and technical conditions of production is embodied. It was thought that this conception would carry over to an interpretation of "capital" as a factor of production, on the same footing as labor, and of profits as a return to such a factor. Indeed it was felt that this transition could be made logically and without

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<sup>1</sup>There is another side of the neoclassical conception which is not dealt with either in this paper or in the recent debates. This is the notion that profits are explained also by the presumed preference of individuals for present over future consumption or their "marginal rate of time preference."

hitch from one situation to the other and back again, because the interpretation of "capital" as a factor of production was presumed to be merely a special and convenient case of a more general case involving production with many different capital goods, or many factors of production, as many as one wished to assume.<sup>1</sup>

The particular construction that was developed for this purpose, that is, as a vehicle for conveying the neoclassical conception of profits as reflecting the relative scarcity and technical productivity of the factor "capital," was that of an aggregate production function. In recent times it has been reconstituted by Samuelson in the form of a "parable" utilizing the

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<sup>1</sup>The confusion involved in this transition was very early pointed out by Bohm-Bawerk. At a later date, Schumpeter ([1954], pp. 655-656) again called attention to it when he wrote:

"For the votaries of the triad scheme and of the theory that incomes are essentially prices (times quantities) of productive services, the natural thing to do was to interpret the yield of capital goods...as a price for the productive services of those capital goods. This again may be done in several ways, though, unfortunately, all of them meet with this fatal objection: nothing is easier than to show that capital goods or their services, being both requisite and scarce, will have value and fetch prices; nor is it difficult to show that their ownership will often yield temporary net returns; but all the more difficult is it to show that -- and, if so, why -- these values and prices are normally higher than is necessary in order to enable their owners to replace them, in other words, why there should be a permanent net return attached to their ownership. This point was not fully brought home to the profession at large until the publication of Bohm-Bawerk's history of interest theories...Until that time (perhaps in some cases even now) people thought (or think) that the easy proof of the proposition that capital goods must yield a return establishes ipso facto that they must yield an income to their owners. This confusion of two different things vitiates all the pure productivity theories of interest...both the primitive ones...and the more elaborate ones..."

concept of a "Surrogate Production Function."<sup>1</sup> It is this construction that I propose to deal with in this paper.

The outcome of the recent debate has been to show that this construction is based on very weak foundations. Indeed, some go so far as to suggest that the whole analytical structure of marginal productivity theory, insofar as it purports to provide a theory of relative shares and of the rate of profits in a capitalist economy, has come crashing down.<sup>2</sup> This outcome, however one views its actual dimensions, is perhaps the best that could have happened under the circumstances. This is for the reason that it clears the air and makes it possible now to return to the basic questions and issues and to the Classical and Marxian manner of treating them.<sup>3</sup>

In what follows, I examine first the internal structure and meaning of the neoclassical parable taken by itself. To appreciate the full meaning of this construction, however, one must situate it in its broader theoretical context. Accordingly, I go on to show how the parable fits into the framework of a specifically neoclassical theory of growth and distribution. The main elements of the recent theoretical critique of this construction are then presented. Some broad conclusions are drawn in the last section.

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<sup>1</sup>See Samuelson [1962]. Recognizing that there are "major troubles" with the neoclassical production function, Hicks ([1965], ch. 24) has proposed the alternative concept of a "sophisticated production function." The arguments considered here apply also to this conception.

<sup>2</sup>Cf. Garegnani [1970].

<sup>3</sup>There is no intention here of equating the Classical (or Ricardian) system of thought with the Marxian theoretical system. For purposes of the present discussion, the basic distinctions which exist between them regarding these and other issues may be ignored.

It must be emphasized that I am concerned throughout with theoretical considerations, specifically with the theoretical structure and foundations of the neoclassical parable, and not with problems of empirical application and testing. Suffice it to say that the analytical structure of the neoclassical conception as presented here has been applied to the study of a wide range of problems at both a theoretical and empirical level. These studies relate to problems of the labor market, the demand for capital and investment, the "optimal" rate of saving, economic stagnation in underdeveloped economies, the "sources of economic growth," the economic effects and requirements of government policy regarding all of these matters, international comparisons of income distribution and "factor prices," and the economic history of capitalist economies. Many such studies exist that are too numerous to mention. They are familiar to the interested observer. I do not go into the question of the meaning and validity of such studies. It should be clear, however, that any assessment of the neoclassical conception at the level of its conceptual structure must have direct consequences for accepting or rejecting its application at the level of such studies.

## 2. The Production Function and Distribution

The neoclassical parable is set out in terms of an economy which produces a single commodity, say, corn, using labor and stocks of corn as capital good. At the center of the parable is the production function for corn or the "surrogate production function":



$$(1) \quad Y = F(K,L)$$

which relates output of corn  $Y$  to inputs of corn-as-capital-good  $K$  and labor  $L$ .<sup>1</sup> Production is assumed to be subject to constant returns to scale ( $F$  is linear homogenous). Because of this we can rewrite (1) per unit of labor as

$$(2) \quad y = f(k) \quad ; \quad y = \frac{Y}{L} \quad , \quad k = \frac{K}{L} .$$

The function  $f(\cdot)$  is continuously differentiable with positive and diminishing marginal products of the factors. In particular, a "well-behaved" production function satisfies the "Inada conditions" (see Inada [1965]):

$$f(0) = 0 \quad ; \quad f(\infty) = \infty$$

$$(3) \quad f'(k) > 0 \quad ; \quad f''(k) < 0$$

$$\lim_{k \rightarrow 0} f'(k) = \infty \quad ; \quad \lim_{k \rightarrow \infty} f'(k) = 0 .$$

The full significance of these conditions will appear subsequently. For the moment their meaning should be clear: it is always possible to find techniques for producing more (or less) output of corn per man by adding to (or reducing) the stock of corn relative to labor (the corn-labor ratio) no matter what the size of that stock is, short of infinity.

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<sup>1</sup>All that is said here applies with equal force to the neoclassical notion of a production function which shifts over time in accordance with technical change.

The preceding describes the available technology. Given this technology and facing competitive markets with given price of output, wage rate of labor  $w$ , and rental rate of the capital good  $r$  (which, in this context, is the same as the rate of profit), firms choose that technique of production (a corn-labor ratio corresponding to a point on the production function) which maximizes profits for the firm (minimizes costs). This requires that in equilibrium that technique is chosen at which the marginal product of each input equals its price. We therefore have the equilibrium conditions

$$(4) \quad r = \frac{\partial Y}{\partial K} = f'(k)$$

$$(5) \quad w = \frac{\partial Y}{\partial L} = f(k) - f'(k)k.$$

By combining (2), (4) and (5), we get

$$(6) \quad y = f(k) = w + rk.$$

Thus, payment of the factors according to their marginal products automatically exhausts the total product, which is in keeping with Euler's Theorem.

The marginal product conditions (4) and (5) express in this context the profit maximizing (or cost minimizing) criterion for choice of technique that would be observed by each and every producer operating in competitive markets. Of course, under competitive conditions, the prices  $w$  and  $r$  are given to the producers. But, from the point of view of the economy as a whole, there is still a question of how these variables are determined. We may

express this point another way by saying that the equations (4) and (5) by themselves are sufficient to determine only two of the three variables,  $w$ ,  $r$ ,  $k$ . One of these variables (or a ratio of two of them, say, the "wage-rental ratio"  $w/r$ ) must be given independently in terms of additional equation(s).

Note that it is at this point that certain analytical complications are being suppressed due to the assumption that there is only one capital good which is the same commodity as the output. In a model of production with many capital goods, if we continue to maintain the neoclassical assumption of a well-behaved production function with the different capital-goods as inputs, then there is a marginal product for each of the capital-goods taken separately in each line of production. The competitive equilibrium condition expressing the profit-maximizing choice of technique is that the money value of the marginal product (which is the marginal product times the price of output) of each type of capital good is equal to the money rental of the capital good (which is the price of the capital good times the rate of profit) and is the same in all lines. Thus the connection between the marginal product of the individual capital goods and the rate of profit is indirect: it goes by way of the prices which themselves depend on the rate of profit. When there is only one produced commodity which serves as capital good the situation becomes quite different. For then the relative price of this commodity is unity (it exchanges one to one against itself). Prices therefore drop out of the marginal product condition and, there being only one capital good, there is correspondingly only one such

condition. A direct relation is thereby established between the marginal product of the capital good, which is a purely technological datum, and the rate of profit.<sup>1</sup> The marginal product of the capital good is in turn uniquely related to the stock of the capital good per man due to the assumptions concerning the production function. It follows that there is a one-to-one correspondence between the stock of the capital good and the rate of profit.

At a given rate of profit, one technique is chosen. At a different rate of profit, corresponding to a different equilibrium position for the economy as a whole, the technique chosen, and hence the corn-labor ratio, would be different. We can derive from the production function and the marginal-product conditions the exact relations that would

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<sup>1</sup>Ricardo dealt with a similar case in constructing his analysis of distribution. With an eye to the importance of agriculture in the conditions of his time, he chose corn as the relevant commodity. Corn could be both an input into its own production and an output which serves as wage-good for the workers. With the wage rate fixed in terms of corn, the rate of profit in corn production is determined as the ratio of net output of corn per man on marginal land minus the wage to the stock of corn per man. In this sense the rate of profit is uniquely determined by technical conditions in the production of corn and by the conditions accounting for the subsistence wage rate in terms of corn. Competition ensures that the same rate of profit enters into the price of all other commodities that are produced with indirect labor. But as soon as it is recognized that the wage consists of other commodities besides corn, the rate of profit can no longer be determined in this way. For the money value of the wage then depends on the prices of the commodities constituting the wage and these prices incorporate the rate of profit. Attention then has to be directed to explaining the rate of profit in terms of the production system as a whole and, for this, the assumption that corn in agriculture is both capital good and output is of no relevance. Even then, there is still a sense in which the rate of profit is uniquely determined by technical conditions and a wage rate specified in terms of physical quantities of the commodities. This is so, for instance, in the case of von Neumann's "Classical" model (see the interpretation of this model by Champenowne [1945]). On the other hand, for the neoclassical parable to hold, it is required not only that there exists a commodity such as corn but that it is the only produced commodity.

prevail among the wage rate, profit rate and quantity of the capital good per man in different equilibria. Specifically, by differentiating (4) and (5) we get

$$(7) \quad \frac{dr}{dk} = f''(k) < 0$$

$$(8) \quad \frac{dw}{dk} = -f''(k)k > 0$$

which give the slopes of the equilibrium relations, the signs of which reflect the assumptions governing the production function. These relations are graphed in Figure 1. Associated with any corn-labor ratio is a unique set of factor prices and vice versa. An increase (decrease) in the quantity of one factor relative to the other is associated with a lower (higher) relative price of that factor.

We can combine the two relations (4) and (5) to get a relation between the wage and profit rates that would prevail in different equilibria. By virtue of the Inada conditions,  $r = f'(k)$  is a single valued function and therefore has an inverse such that

$$(9) \quad k = k(r) \quad ; \quad k' < 0.$$

Substituting (9) and (4) into (5) gives

$$(10) \quad w = f[k(r)] - rk(r).$$

This is the wage-profit frontier corresponding to the given technical conditions. A frontier such as this, giving the wage and profit rates consistent

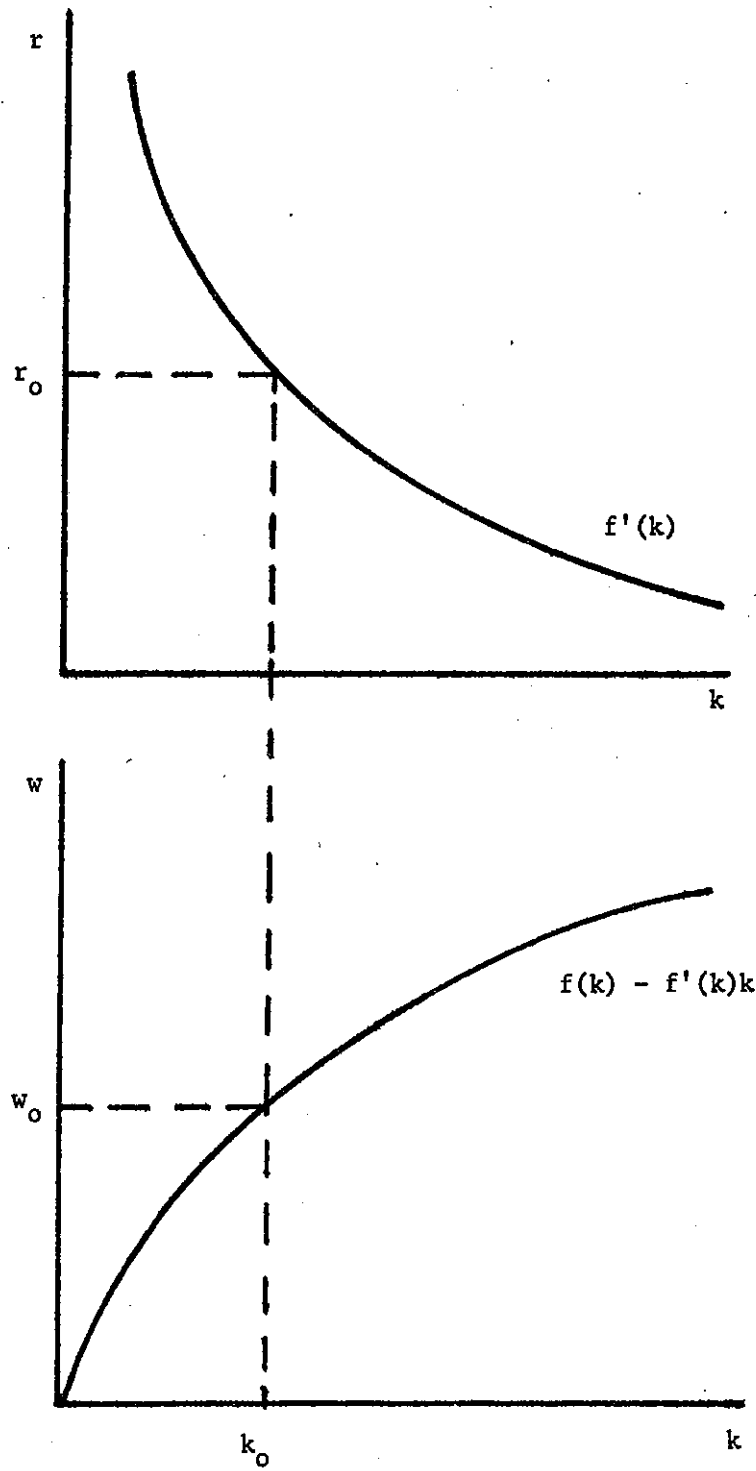


Figure 1.

with the given technology under competitive conditions, could be computed from any technology in which any number of commodities (not just one) are produced by themselves and labor.<sup>1</sup> Because of the special conditions underlying this particular frontier, however, certain special results follow. Specifically, from differentiation of (10) (or from dividing (8) by (7)) it follows that

$$(11) \quad - \frac{dw}{dr} = k,$$

so that the absolute value of the slope of the frontier at any point on that frontier is equal to the quantity of the capital good per man. Furthermore, after multiplying (11) by  $r/w$  we get

$$(12) \quad - \frac{r}{w} \frac{dw}{dr} = \frac{rk}{w} = \pi$$

which says that the elasticity of the frontier at any point is equal to the ratio of total profits per man and wages per man or the relative share  $\pi$  of profits and wages in the net product.<sup>2</sup>

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<sup>1</sup>Cf. Sraffa [1960]. This relation was named the "factor-price frontier" by Samuelson [1962]. Names are, of course, important. The importance of this particular name is that it expresses the neoclassical conception of profits as the price or reward of a "factor." But this is to attach a particular view of the nature and origin of profits arising out of a particular theory of profits to a relation which is equally consistent with any relevant theory of profits.

<sup>2</sup>Were it not for the special conditions underlying it, this might be thought to be a remarkable result. Samuelson, who was the first to derive it, evidently thought so. He remarked in this connection: "...the Frontier can...give us more information than merely what the wage and profit rates will be at any point. Improbable as it may first seem to be, it is a fact that the behavior of stationary equilibria in the neighborhood of a particular equilibrium point will completely determine the possible level(s) of relative factor shares in total output at that point itself. It is as if going from New York to its suburbs were necessary and sufficient to tell us the unseen properties of New York City itself." (ibid., p. 199).

Thus the parable tells us that, knowing only the quantity of the capital good per man and the technology, we can find from the frontier the corresponding wage and profit rates that would rule under competitive conditions. The elasticity of the frontier at that point gives the relative share of profits and wages. The distribution of income is therefore completely determined by technology and relative factor "endowments." An increase (decrease) in the quantity of one factor relative to the other lowers (raises) its price. The distribution of income varies accordingly, depending on the particular form of the technology, that is, depending on the "elasticity of substitution."<sup>1</sup> In this way, the analysis incorporates the argument that relative factor prices reflect relative "scarcity" of the different factors and the amount which each factor gets from the national product is determined by technology and relative factor endowments.<sup>2</sup>

All of this story is "true," meaning logically consistent, for a "one-commodity" world, that is, a world in which only one commodity is produced. Beyond this, it is claimed that this story can be used as a "parable," or a stand-in, for a more complex world in which many commodities are produced

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<sup>1</sup>On the role of the elasticity of substitution, see Hicks [1936] and Allen ([1967]ch. 3). When the elasticity of substitution is unity, as in the case of the well-known Cobb-Douglas production function, the distribution of income is independent of the capital-labor ratio and depends only on the technology.

<sup>2</sup>As J. B. Clark ([1891], p. 313) earlier expressed it: "What a social class gets is, under natural law, what it contributes to the general output of industry."



and there are many different capital goods. The production function, it is argued, can serve as a "surrogate" for the relations which prevail in this sort of world.<sup>1</sup>

On the face of it, given the very special assumptions on which the parable is constructed -- the one-commodity assumption is especially severe -- one might be tempted to dismiss the parable as simply uninteresting, if not irrelevant. As Joan Robinson has suggested in this connection, it is rather like putting the rabbit into the hat in full view of the audience and then pulling it out again. Suppose, however, that we agree to treat it seriously as a theoretical construct. We might then go on to examine to what extent, if at all, the relations which hold in the parable world can be said to represent the relations in a more complex world. One need not thereby accept the conception of theory as "parable" or "fairy tale."<sup>2</sup> Instead, it is possible to view the preceding formulation as a first approximation based on simplifying assumptions. Further theoretical analysis then needs to be carried out through introducing the relevant complications and checking to see whether the essential propositions of the parable continue

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<sup>1</sup>To quote Samuelson (1962, p. 194): "...we can sometimes predict exactly how certain quite complicated heterogeneous capital models will behave by treating them as if they had come from a simple generating production function (even when we know they did not really come from such a function)." And again (p. 201): "...simple neoclassical models in a rigorous and specifiable sense can be regarded as the stylized version of a certain quasi-realistic...model of diverse heterogeneous capital goods processes."

<sup>2</sup>Neoclassical writers in the recent tradition have been noticeably reluctant to state explicitly their own methodology. It is therefore difficult to grasp what exactly is intended to be the scientific status of the notion of "parable" or "fairy tale" (these terms are due to Samuelson). This is especially so in view of the innumerable attempts that have been made to obtain direct estimates of the production function, recognized as a relation located in a "parable" world, from empirical data generated in the "real" world.

to hold. The implications of introducing some of these complications form the chief basis of the recent critique of the neoclassical parable. The main elements of this critique are presented in sections 5 and 6. Before going on to that, we consider in the next section how the parable fits into the broader context of the neoclassical theory of growth and distribution.

### 3. The Neoclassical Theory of Growth

Is it possible to have steady growth with full employment in a capitalist economy? This is the question, as posed in recent times by Harrod (1948), to which the neoclassical theory of growth was designed to provide an answer.<sup>1</sup> Harrod's answer to this question, it will be recalled, was that there existed only one "warranted" rate of growth at which the economy could expand consistent with equilibrium of saving and investment. Therefore, only by accident could this rate equal the "natural" rate made possible by growth of the labor force and technical change. If the actual rate happened to differ from the warranted rate the system was unlikely ever to achieve equilibrium. Instead it might proceed by a series of investment booms interrupted by slumps or relapse into a state of complete stagnation.

In the neoclassical theory, by contrast, the warranted growth rate can always be made equal to the natural rate whatever the latter might be. Furthermore the system tends to approach an equilibrium of steady growth

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<sup>1</sup> Consideration of this question did not, of course, begin with Harrod's formulation of it, contrary to the impression conveyed by subsequent discussions. Indeed, it needs to be emphasized that the problem of accumulation and expansion in a capitalist economy was a central concern of the classical economists and of Marx. Marx, in particular, had succeeded in formulating a clear-cut and consistent theory providing answers to the relevant questions, including the one which Harrod posed. See, for instance, Karl Marx, Capital, Vol. 1, ch. 25; Vols. 2 & 3, passim, and Harris [1972].

starting from any position different from that which is required for steady growth. The essential core of this theory, starting with the contribution of Solow (1956), was set out utilizing the concept of an aggregate production function as described in the previous section. Its contents can be sketched as follows.

Let there be given quantities of corn-as-capital-good  $K_0$  and of labor  $L_0$  available for employment. At any moment the available supply of factors is thrown inelastically upon the market. Factor markets can clear if factor prices settle at a level such that firms are willing to choose, in accordance with the profit maximizing criterion expressed in equations (4) and (5), the particular combination of factors consistent with the available supply  $(K_0, L_0)$ . In this sense there can always be full employment of available labor and "capital" provided that wage and rental rates in real terms (that is, in terms of corn as numeraire) are free to settle at the appropriate level. Unemployment can occur only if, for some unexplained reason, the wage rate (or rental rate) is too high. In formal terms, what this means is that the procedure described in the previous section for obtaining the profit maximizing choice of technique is now reversed. Instead of finding the corn-labor ratio appropriate to a given wage or profit rate we now find the wage and profit rates appropriate to given quantities of the factors. The assumed properties of the production function ensure the existence of a unique solution at positive levels of  $w$  and  $r$  for any arbitrary quantities  $K_0, L_0$ .

On the side of output and demand it is required for equilibrium that saving equals investment. Of course, in the parable world, whatever is

not consumed (saved) from the total output of corn must be invested. This is because corn is the only form in which wealth can be accumulated and its investment in production always yields the going rate of profit. Thus there can never be any discrepancy between saving and investment decisions. The Keynesian problem of unemployment due to shortage of "effective demand" is thereby ruled out.

With full employment thus assured the equilibrium level of income is obtained from the production function. Assume now that saving is a fixed proportion  $s$  of total income. For saving-investment equilibrium we have

$$(13) \quad I = sY$$

and the warranted rate of growth of "capital" is then

$$(14) \quad g = \frac{I}{K} = \frac{sf(k)}{k}.$$

Suppose that available labor grows over time at a constant rate  $n$  which is exogenously determined

$$(15) \quad L = L_0 e^{nt}.$$

For steady full-employment growth at a constant corn-labor ratio it is required that the stock of corn grow at the same rate as labor, or

$$(16) \quad g = n.$$

From (16) and (14) we see that what is required is that

$$(17) \quad \frac{f(k)}{k} = \frac{n}{s}.$$

The assumptions concerning the production function ensure that there always exists a unique value of the corn-labor ratio which provides a solution to

this equation. The solution is illustrated in Figure 2. Given the labor-force growth rate  $n$ , the saving proportion  $s$  (or their ratio  $n/s$ ) and the technology represented by  $f(k)$ , we find a value of  $k = k^*$  such that  $n/s = f(k^*)/k^*$  and it is unique.

It is easy to go on to show in this framework that, starting from any position which is different from that required for steady growth (implying that  $k_0 \neq k^*$ ), the economy will undergo an adjustment process leading eventually to attainment of steady growth. Suppose that, by historical accident as it were, the economy starts out in a position where saving out of full-employment income exceeds the investment required at the existing corn-labor ratio to provide employment for the increment in the labor force. The existing corn-labor ratio is, so to speak, too low. In Harrod's terms we have a situation where the warranted growth rate exceeds the natural rate. Since the available saving is automatically invested, the total stock of corn per man rises by the amount of this saving. Once the investment has been made, it turns out that there is too much corn to employ the available labor with the existing production technique. Competition among firms for the available labor drives up the wage rate and, correspondingly, the rate of profit falls. At a higher wage rate (lower profit rate) firms find it now profitable to adopt a technique with a higher corn-labor ratio. The wage rate rises to the point where that corn-labor ratio is selected at which all the available stock of corn is fully utilized and the excess demand for labor disappears.

If the warranted growth rate continues to exceed the natural rate in subsequent periods, these adjustments are repeated. As the process

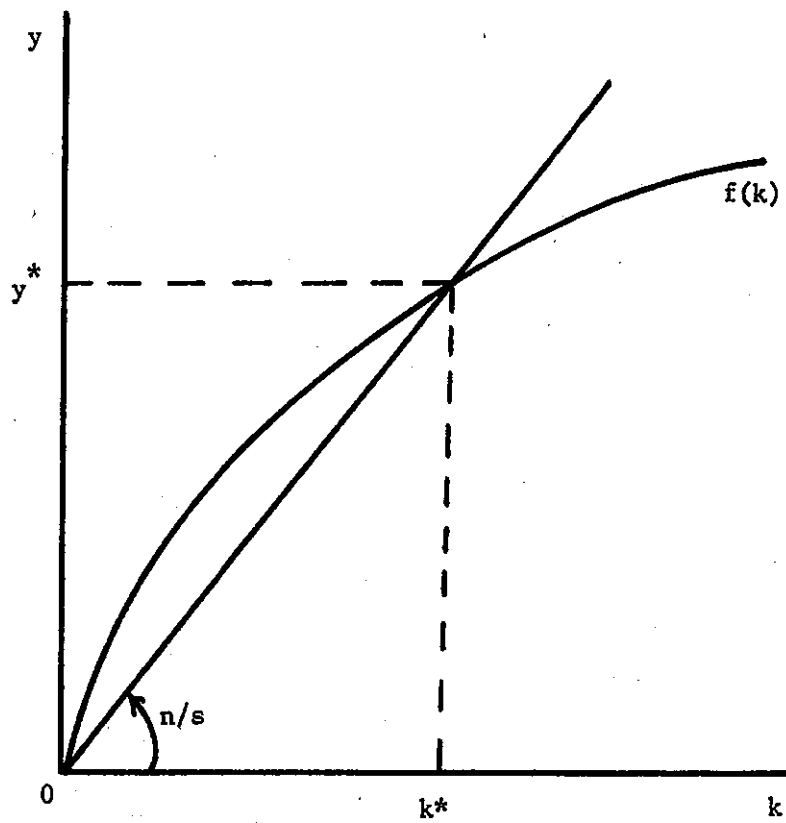


Figure 2.

continues, the total stock of corn per man is rising all the time, the rate of profit is falling and the technique of production is being continually adjusted, a higher corn-labor ratio for a lower profit rate, so as to maintain full utilization of "capital" and labor. But, as the corn-labor ratio rises in this way, the same amount of saving provides less and less employment. Eventually, a point is reached where the corn-labor ratio is such that the available saving is just sufficient to employ the increment in the labor force. The gap between warranted and natural growth rates is then eliminated and the situation becomes consistent with a steady state.

When the warranted rate is less than the natural rate, a similar process operates in the opposite direction. In this case, the amount of saving is not enough to employ the increment in the labor force. The wage rate falls (the profit rate rises) and correspondingly the corn-labor ratio falls until a steady state is reached.

All of this shows that the system is stable in the sense that any departure from the steady state will bring into operation an adjustment process such as to induce a return to it.

The argument is illustrated in Figure 3 for the case of a uniform saving proportion. The curve  $sf(k)$  represents the amount of saving at full employment for each level of the corn-labor ratio  $k$ . The curve  $nk$  represents the investment required to maintain full employment at each corn-labor ratio when the labor force grows at the rate  $n$ . If  $sf(k)$  is above  $nk$  then  $k$  is rising; if below, then  $k$  is falling. The arrows indicate the direction of movement in each case. The appropriate steady-state value of  $k$  is  $k^*$ .

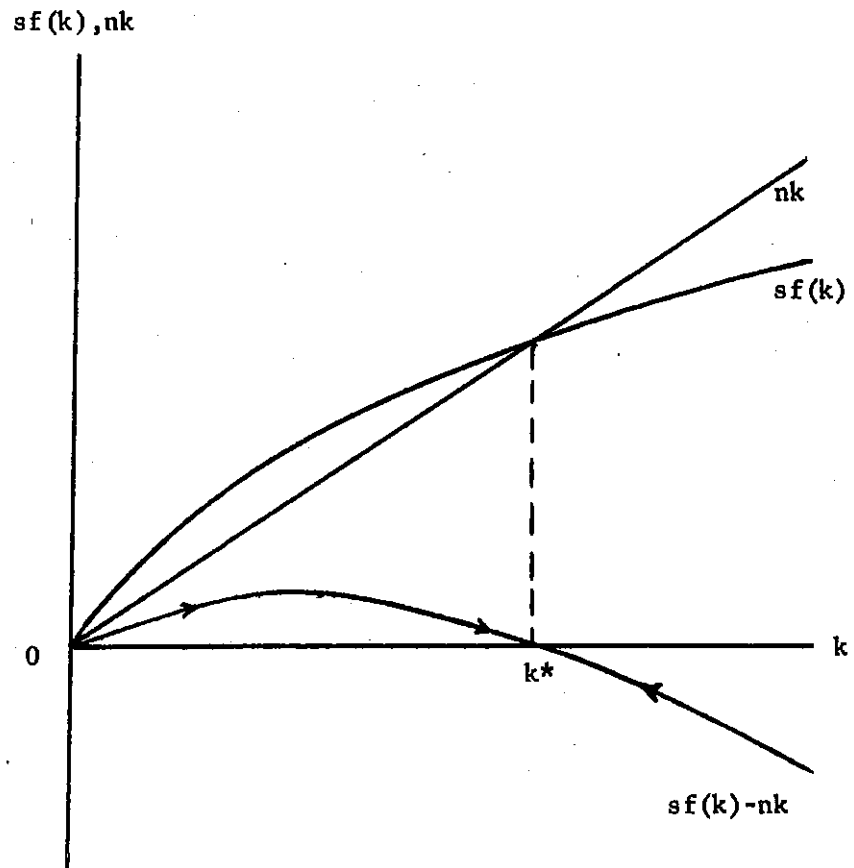


FIGURE 3.



It may be noted that the argument is conducted throughout in terms of a process of movement "up" (or "down") the production function. Specifically, the economy is assumed to undergo a process of accumulation involving a continuous increase (decrease) in the stock of corn per man while the rate of profit falls (rises) and the technique of production is continually adjusted to each successive level of the profit rate. Here we see the significance of the assumptions concerning technology and production. In particular, accumulation consists of adding part of the output of corn to the stock of corn already in existence. A change in production technique for the entire stock of pre-existing and "new" corn can be implemented instantaneously and without cost in response to a change in "factor prices" simply by varying the quantity of corn per man employed. In this sense, there is direct substitution of "capital" for labor. Because of the assumptions concerning the production function, such substitution can be carried out indefinitely while continuing to yield positive wage and profit rates. Therefore, full employment of available labor and "capital" is always guaranteed whatever might be the size of the labor force and stock of "capital." Furthermore such substitution can always go on until the steady state is reached.

A striking feature of this analysis is thus that there is no need to distinguish between the comparison of different steady states and a process of change through which an economy moves. Every point on the production function corresponds to a particular steady state, each with a given set of conditions, as well as to a point on the path of movement of an economy towards a steady state. All of this is made possible by the assumption of

a one-commodity economy. In such an economy, there is no such thing as a given stock of capital goods specific to particular uses. The stock of "capital" can at any moment be adapted to employ any quantity of labor and produce any quantity of output without requiring a process of transformation of the pre-existing stock. Accordingly there is no problem of the degree of utilization of a given stock of capital equipment varying with the level of demand in the short run. Indeed, there can be no problem of demand at all since whatever is produced is either consumed or invested. Say's Law holds without exception. It is assumed, moreover, that "factor prices" are free to respond appropriately in any given situation. In particular, the real wage rate moves up or down to the appropriate extent in response to any excess demand or supply of labor. The profit rate falls or rises as soon as there is any oversaving or undersaving.

There is an obvious question in all this as to whether and, if so, how the process of adjustment would work itself out in an economy in which stocks of equipment are specific to different uses and there is a (changing) structure of relative prices of the different commodities, in which firms make investment decisions in the light of expectations of future profits, wealth is held in the form of money and the wage rate (in terms of money) is set by bargaining between workers and employers. The preceding analysis is incapable of dealing with these matters by virtue of the assumptions on which it is based. In this connection, it may be noted that the process by which a capitalist economy is supposed to adjust from any arbitrary

initial position to a steady state raises a number of serious analytical problems for the neoclassical theory, once allowance is made for the existence of more than one capital good. (On this see, for instance, Hahn [1968].) These problems are effectively suppressed within the framework of assumptions of a "one-commodity model." What is involved here, quite apart from the other matters discussed in this paper, is the failure of the neoclassical theory to provide an account of the process of change ("disequilibrium dynamics") in a capitalist economy, except through the artificial device of a "sequence of momentary equilibria."<sup>1</sup>

#### 4. Neoclassical Theory of Growth and Distribution

We can now bring together the basic elements of the scheme so as to exhibit the nature of the interdependencies and causal links that are involved. These relations are depicted in Figure 4. The production

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<sup>1</sup> Joan Robinson refers to the neoclassical conception of a process of accumulation with changing technique and falling rate of profit as a "Wicksell process," noting that "Wicksell himself gave it up in despair." She points out that "The difficulty of the problem arises . . . from attempting to rig up assumptions to make it seem plausible that a private-enterprise economy would continuously accumulate, under long-period equilibrium conditions, with continuous full employment . . . , without any cyclical disturbances, in face of a continuously falling rate of profit" (Robinson [1959], p. 433).

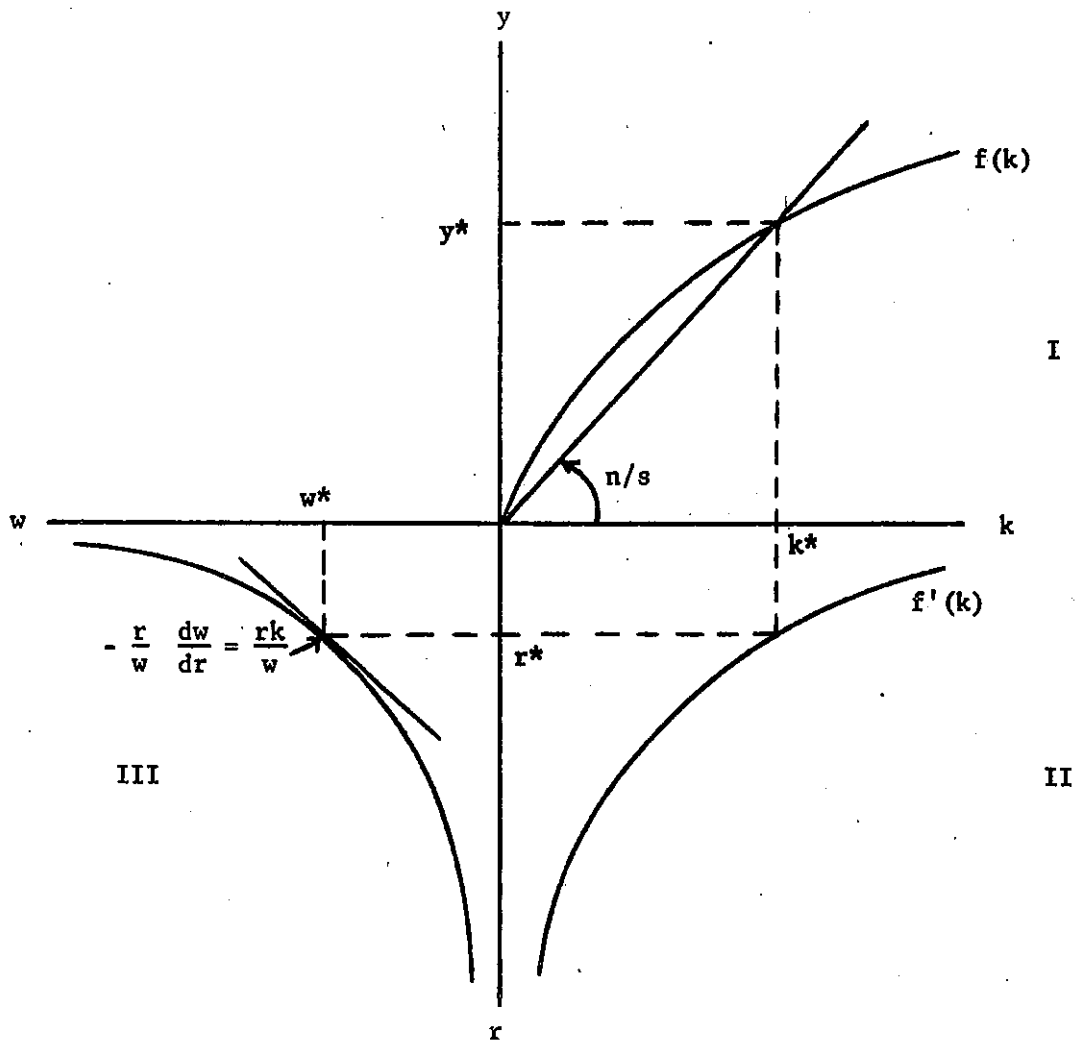


FIGURE 4.

function is drawn in quadrant I. Quadrant II gives the equilibrium profit rate consistent with each corn-labor ratio. Quadrant III describes the wage-profit frontier corresponding to the given technology.

From the point of view of the problem of distribution, it can be seen that the basic idea here is that of a one-to-one correspondence between the relative size of factor endowments (the corn-labor ratio) and the price of those factors and hence the distribution of income. Once we know the factor endowment  $k$  and the technology corresponding to the production function  $f(k)$ , we can find from the frontier the corresponding distribution of income. When this notion is imbedded in a theory of growth, a further explanation is provided concerning the determination of relative factor endowments. Corresponding to a given saving proportion and growth rate of labor there is a unique corn-labor ratio consistent with steady growth, as in quadrant I. A higher saving rate is associated with a higher corn-labor ratio; a higher growth rate of labor with a lower corn-labor ratio. From quadrants II and III we see that the distribution of income varies according to the level of the corn-labor ratio. We conclude from this that the distribution of income depends on factor endowments and on technology. Factor endowments are in turn the result of the habits of thrift of the population represented by the uniform saving proportion  $s$  and the forces underlying expansion of the labor force at the rate  $n$ .<sup>1</sup>

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<sup>1</sup>Note, however, that this interpretation hinges critically upon the assumption of a uniform saving proportion for all categories of income and all classes. When the overall rate of saving depends upon the distribution of income between profits and wages, the profit rate and corn-labor ratio are simultaneously determined. There is then no room for a one-way relationship between factor endowments, technology and income distribution. Furthermore, if it is assumed that saving out of wages is zero, the profit rate is determined by the growth rate and the saving proportion for profits and is independent of technology and factor endowments. Similarly, under the conditions of Pasinetti's [1962] theorem, the profit rate is completely determined by the growth rate and saving propensity of a class of "pure capitalists."

It is evident also that what pulls the economy forward in this scheme is the expansion of the labor force, the rate of such expansion being an unexplained datum. Given this growth rate and the saving habits represented by  $s$ , the rate of accumulation adjusts so as to provide the "capital" required to maintain full employment of the available labor force at the corn-labor ratio appropriate to a steady-state. Steady growth at full employment is guaranteed by the assumption of (1) firms which are willing to carry out investment corresponding to whatever saving is going on, (2) a technology which always allows for choice of the appropriate technique of production, and (3) markets for labor and "capital" which ensure the wage and profit rates consistent with that technique.

It is important to see that, insofar as the saving proportion  $s$  and the labor force growth-rate  $n$  are merely taken as given (that is, their status in the theory is that of parameters), then this formulation is consistent with any theory of saving and any theory of labor force growth which determines the quantities  $s$  and  $n$  in terms of exogenous conditions.<sup>1</sup> Of course, the assumption that these quantities can be con-

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<sup>1</sup>This means specifically that there is no necessity, except for the purposes of a particular theory, to appeal to the presumed "inter-temporal preferences" of individuals as the determinant of savings and the presumed "work-leisure preferences" of individuals as the determinant of the labor supply. This is an appeal which is usually made on the basis of a "full-blown" neoclassical theory, the neoclassical theory of general equilibrium. But what should be clear from the present discussion is that any other theory would do just as well.

sidered as exogenously determined is already quite special. But what is specific to the neoclassical theory as a theory of growth is the attempt to argue that there always exists in a capitalist economy a unique state of steady growth with full employment to which the economy will adjust given enough time. What is even more specific to the neoclassical theory as a theory of distribution is the attempt to argue (on the basis of the particular assumptions about technology and saving behavior) that the distribution of income is uniquely determined by technology and factor endowments.

A number of theoretical elaborations of this scheme are possible, all hinging on the specified properties of the production function. For instance, it can be shown that lower profit rates are associated with higher corn-labor ratios and these with higher levels of output and consumption per man up to a maximum. This association is thought to be consistent with the neoclassical idea that lower profit rates give rise to investment in "more mechanized" techniques of production which yield greater output and consumption per man as a return to the "sacrifice" of current consumption involved in investing in the more mechanized technique.<sup>1</sup> The "golden rule of accumulation" can be shown to hold so that consumption per man is maximized when the rate of profit is set equal to the rate of growth (see Phelps [1966], Koopmans [1965]). By a slight reconstruction the analysis has also been made to apply to the problem of stagnation in underdeveloped economies (see Solow [1956] p. 90, Nelson [1956], Buttrick [1958, 1960]).

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<sup>1</sup>This element of the neoclassical conception is discussed in section 6 below.

## 5. A Theoretical Critique

So far as the formal structure of this scheme is concerned, it might appear, on the surface of it, to be a charming edifice. For, in one stroke, two sets of problems appear to be solved. First, the analysis shows that steady growth with full employment is always possible in a capitalist economy and will tend to be established starting from any position. Secondly, the distribution of income on the steady-state path is explained as a function of technology and prevailing factor endowments, those endowments being related to saving behavior and population growth. But it is necessary to examine further into the substance of this construction and the propositions derived from it.

There are a number of directions in which it is possible to go. One could point to the existence of periods of chronic unemployment of labor and excess capacity in the advanced capitalist economies and note that there is no room in this scheme for introduction of such considerations. There is no room also for introduction of any distinction between saving and investment decisions and therefore for assigning any autonomous role to investment plans of firms in the accumulation process. For, in the one-commodity world, saving represents a decision not to consume part of the current output of corn and this amount of corn automatically corresponds to an investment in corn as capital good. There is, moreover, no room for the introduction of monopoly influences on price formation and on the utilization of production capacity through the level of the markup of prices over costs. Beyond this, one could go on further to confront this scheme with



alternatives which allow for the introduction of such elements and which offer answers to the relevant questions.<sup>1</sup>

A more limited task is undertaken here. I consider in this section some reasons for the failure of the neoclassical conception related to the internal logic of that conception itself.<sup>2</sup>

One may note in this connection that a central element of the parable is the idea of an inverse monotonic relation between the quantity of "capital" per man and the rate of profit. On this relation rests the conception that profits are the return to a factor of production, the rate of profits varying according to the scarcity of that factor relative to labor. On this relation rests also the notion that technical substitution between "capital" and labor as factor prices change can be relied upon to bring about a state of steady growth with full employment. For this relation to hold in a world of heterogeneous capital goods the parable strictly requires that there exist some measure of the quantity of "capital," representing all of the different capital goods, which, when it is put into a production function of the form

$$(2) \quad y = f(k); \quad f'(k) > 0, f''(k) < 0,$$

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<sup>1</sup>A detailed discussion of the alternatives offered by Neo-Keynesian theory and Marxian theory is presented in my forthcoming book, Theories of Growth and Distribution.

<sup>2</sup>The argument is based on analytical results established in the work of various participants in the recent debate.

would satisfy the marginal product condition

$$(4) \quad r = f'(k)$$

and satisfy, in addition, the product-exhaustion condition

$$(6) \quad y = w + rk.$$

The relation (4) provides the linch-pin of this whole approach. More generally, it posits a single-valued relation between the quantity of "capital" per man and the rate of profit such that

$$r = \varphi(k), \quad \varphi' < 0,$$

and

$$k = k(r) = \varphi^{-1}(r).$$

If such a relation existed, it is argued, the parable would provide a "good" representation of the world of heterogeneous capital goods. With the production function, we could "predict" the unique value of  $r$  corresponding to any given value of  $k$ . In this sense we could say that technical conditions and relative factor endowments "explain" the rate of profit.

Outside of the conditions under which the parable itself is constructed, however, there is no theoretical justification for assuming in general that the overall quantity of "capital" per man should be inversely related to the profit rate, let alone that it should go from zero to infinity (with output per man increasing accordingly) through technical substitution of "capital" for labor and that the relation should be continuously differentiable. In general, the capital goods which enter into production consist of heterogeneous commodities. They can be expressed as a single quantity by

valuing them at their respective prices, or exchange values, in terms of a chosen numeraire. There is a different set of prices for each level of the profit rate, the exact pattern of differences depending on the technical conditions of production of the different commodities.<sup>1</sup> The physical quantity of the capital goods and the methods by which they are produced may also be different from one equilibrium profit rate to another. The variation of the overall exchange-value of capital per man between different steady states can be viewed in terms of a price effect, a composition effect and a substitution effect.<sup>2</sup> But, conceived in this way, the ratio of capital to labor cannot be regarded as necessarily an inverse function of the profit rate.

The quantity of capital in this sense, that is, as a sum of exchange value obtained by valuing the different capital-goods at the ruling prices, depends on the rate of profit.<sup>3</sup> Therefore, one cannot argue that the quantity of this capital (or its "marginal product," whatever that might be supposed to mean in this context) determines the rate of profit without reasoning in a circle. For there is in general no one-way connection going from the quantity of capital in this sense to the rate of profit.

To express the different capital goods in terms of a single number one could have recourse instead to a number such as their physical

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<sup>1</sup>The reason for this is clear. In competitive equilibrium, prices equal money costs of production consisting of wages plus profits calculated at the ruling rate on the exchange value of the stock of capital goods employed. At a higher (lower) rate of profit the wage rate is lower (higher). The difference in total costs and price depends on the exact pattern of employment of labor and means of production throughout the whole interdependent production system. For a detailed analysis see Sraffa [1960].

<sup>2</sup>For an analysis of this relation in these terms see Harris [1973].

<sup>3</sup>So far as the prices are concerned it can be shown that, under fairly general conditions, these are uniquely determined in terms of technical conditions and the rate of profit and are independent of the composition of demand. This is the full significance of the well known "non-substitution theorem." For this result to hold, the rate of profit has to be, so to speak, given in advance.

weight. But then there would be, in general, no unique inverse relation between that number and the rate of profit. And, whether unique or not, it would be an economically uninteresting relation except to the extent that all commodities embody some quantity of a particular commodity, say, steel. By contrast, the number representing the exchange value of the stock of capital goods does have economic interest, though from a different point of view. Namely, it represents the market value of the property which the capitalists own and in terms of which each receives a share in the total of profits generated in the economy (and in terms of which, also, his social position is presumably measured).

Heterogeneous capital goods, as the products of labor, can of course be reduced to the quantity of labor directly and indirectly embodied in them, that is to say, to their labor value. This particular quantity provides as good a measure as any other of the quantity of "capital" in homogeneous units. It would not, however, be an appropriate measure from the point of view of the neoclassical conception. This is for the reason that, measured in this way, capital is then simply a quantity of labor, embodied or "stored up" in means of production. Therefore the quantity of capital in this sense could be assigned no independent existence as a factor of production, separate and distinct from labor, which receives a share in the product in accordance with its technical productivity. By contrast, from the point of view of Marxian theory, this measure, the labor value measure, would be the

theoretically correct one for analysis of distribution and carries a special qualitative significance within the framework of that theory. Specifically, its significance is that, among other things, it expresses the social-historical character of capital as the productive power of labor materialized and transformed into objects that become instruments for domination of the laborer through his employment to the capitalist.<sup>1</sup>

In moving from the parable world of one commodity to a more complex world of production with heterogeneous capital goods we find also that the neoclassical argument runs up against another difficulty which is related to, but analytically distinct from, the previous one. This takes the form of the reswitching of techniques of production, that is, the recurrence of the same technique at different levels of the profit rate even though that technique is dominated by others at intermediate levels of the profit rate.<sup>2</sup> It follows from this result that, in general, techniques cannot be uniquely ordered according to the rate of profit. The neoclassical production function is based on the assumption that such a unique ordering exists. It is on this basis, as we have seen, that an attempt is made to draw a direct and unique connection between technology and distribution. But this assumption is contradicted as soon as allowance is made for such a small complication as

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<sup>1</sup>On this see Marx ([1963], pp. 389-92). Marx points out here that "his [the capitalist's] domination is only that of materialised labour over living labour, of the labourer's product over the labourer himself."

<sup>2</sup>On this, see Sraffa ([1960], ch. 12).

that the method of production of the capital good differs from one technique to another.<sup>1</sup> The presumed connection between technology and distribution is thereby effectively destroyed.

As a formal matter, the essential point in all this is that the neoclassical parable assumes that "capital" is a homogeneous substance measurable independently of distribution, the quantity of which can therefore be made to "explain" distribution. In this form, "capital" is a direct input into the production process and can thus be put on the same footing as labor (considered as a homogeneous unit). But "capital" can be so regarded on one assumption only, that is, that there is a given price system for measuring the various commodity inputs and that this price system is invariant with respect to the rate of profit. This in turn presupposes that only one commodity is produced or that different commodities are perfect technical substitutes in production so that the price ratio between them is fixed.<sup>2</sup> This is the special construction on which the neoclassical parable is initially based. When the scaffolding is removed, various assumptions have to be introduced if the initial structure is to be maintained. These assumptions are essentially of an ad hoc character.<sup>3</sup> They therefore provide weak foundations on which to base a theory of distribution and growth.

<sup>1</sup>See, for instance, Bruno et. al. [1966].

<sup>2</sup>Champernowne [1953] has constructed a "chain index of capital" which, under some quite restrictive conditions, permits a unique ordering of techniques in relation to the profit rate and satisfies the marginal product condition for any two consecutive techniques in that ordering. For such a "chain" to be constructed, however, the rate of profit must be treated as an independent variable which cannot therefore be explained by the quantity of "capital" in this sense. Recently, in seeking to get away from the problem of an aggregate measure of "capital" that would be consistent with the neoclassical parable, Solow [1965] has defined a new concept, the "social rate of return," and shown that it is equal to the rate of profits. Pasinetti [1969] shows that this concept is a purely definitional relation and cannot in any meaningful sense be said to determine the level of the rate of profits.

<sup>3</sup>Hahn [1965] grants that they are all "terrible" assumptions.

6. Consumption and the Rate of Profit

Another element of the neoclassical conception is the notion that capital is "productive" in the sense that investment in "more capital-intensive," "more mechanized," or "more roundabout," methods of production yields greater consumption per man (up to a maximum). As Samuelson ([1973], p. 598) expresses it: "It is taken to be a technological fact of life that you can get more future consumption product by using indirect or roundabout methods." The increment in consumption is regarded as the return to the "sacrifice" of current consumption involved in investing in the more mechanized technique. The profit (interest) rate is supposed to reflect, on the one hand, the trade-off between the return of future consumption and the sacrifice of current consumption consistent with the prevailing preference of "society." On the other, it is supposed to reflect the "net productivity of capital" viewed as a technical characteristic of the roundabout methods.

It is not evident, at this level of analysis, what meaning is to be given to the concept of "society" conceived independently of the social classes which compose it in a capitalist economy and the distribution of income and property among those classes and to the concept of "sacrifice" related to saving which the argument presupposes. For this purpose, an appeal must be made to the presumed preference for present over future consumption or the "marginal rate of time preference" of the rentiers who lend finance to the capitalist firms to carry out accumulation. But as to why there should necessarily be a positive rate of time

preference in this sense for society as a whole has never been satisfactorily explained.<sup>1</sup>

Whatever might be thought of the presumption concerning time preference (or "abstinence," or "waiting"), it can be seen that the logic of the argument requires, first, that the profit rate falls as the degree of capital intensity or roundaboutness increases in consequence of the sacrifice of present consumption. Here we have reliance being placed again on the presumption of an inverse relation between the rate of profit and the capital-intensity of production as measured, for instance, by the quantity of capital per man. Now, however, it is required in addition that consumption per man rises as the profit rate falls and capital per man increases. On this basis, we should therefore expect to find in any production system that there exists an inverse relation between consumption per man and the profit rate (up to a maximum of consumption) within the range of available techniques. This is a relation which is required to hold at the level of production.

It turns out, however, when we examine a given production system, that the very opposite relation may be found. In particular, as between different steady states, a lower rate of profit may be associated with either the same or a lower level of consumption per man.<sup>2</sup> This possibility is clearly demonstrated by the existence of reswitching

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<sup>1</sup>Ultimately, the presumption is based on Bohm-Bawerk's Reasons for the existence of interest. On this, see Bohm-Bawerk [1959]. For an early attack on this conception in the context of the subjective theory of value, see Bukharin [1972].

<sup>2</sup>This was pointed out by Morishima ([1964], p. 126).



of techniques of production. Specifically, reswitching means that the same technique is adopted at both a high and a low rate of profit though not at profit rates in between. With the same growth rate prevailing in the two situations, consumption per man would be the same. Thus it is possible for the profit rate to be lower without any alteration in technical conditions and in the associated stocks of capital goods and without any difference in consumption per man. It would thus seem, in this case, that the profit rate is divorced from any connection with the "net productivity of capital" and from anything to do with the "sacrifice" of consumption for future return. The situation described could, of course, be explained within the framework of a theory of exploitation by noting that, at the lower profit rate, the wage rate is higher. Therefore the rate of exploitation is correspondingly lower.

The possibility of reswitching of techniques of production cannot be ruled out in general. Moreover, even in production systems where reswitching does not occur, it could happen that consumption per man is lower when the profit rate is lower.<sup>1</sup> All of this makes for the untenability of the neoclassical conception insofar as this particular element of it is concerned. Samuelson [1966], in his "summing up" of the reswitching debate, acknowledges this. He seems also to suggest (p. 582) that there is some way in which it may be possible to discover that situations which are incompatible with the neoclassical requirement are "empirically rare." But it is not at all clear what sort of empirical evidence, if any,

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<sup>1</sup>On this, see for instance Bruno, et. al. ([1966], pp. 548-50).

could be brought to bear on the matter at this level of analysis. The issue is rather a theoretical than an empirical one. The conclusion one can draw is that there is no reason, at the level of abstractness and generality at which this analysis is situated, to assume the validity of the neoclassical conception except by arbitrarily ruling out the situations in which it is invalid.

## 7. Conclusion

Going beyond the failure of the neoclassical parable, however, it needs to be recognized that the parable, as a theoretical construct, does not stand by itself in complete isolation. Rather, it stands in a very definite relation to the whole corpus of neoclassical theory. Samuelson ([1962], p. 193) grants as much when he indicates that ". . . such simple models or parables do, I think, have considerable heuristic value in giving insights into the fundamentals of interest theory in all its complexities." We come here to the real meaning and significance of the neoclassical parable. What the neoclassical parable reveals is the basic conceptual structure, the "fundamentals," of a theory that, in all its complexities, was designed to explain distribution (and growth) in a capitalist economy.<sup>1</sup> The parable serves to give an identifiable shape

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<sup>1</sup>It seems important to emphasize here that, in the context of a capitalist economy, the category of interest, whatever else it might be supposed to mean, is first and foremost a category relating to the distribution of income. It is the income which accrues to the owners of capital and can be used in this generic sense interchangeably with the term profits which is used in this discussion. For present purposes, the rate of interest and rate of profits are synonymous. For other purposes it may be relevant to distinguish, say, between the profits which accrue to a given enterprise and the interest which that enterprise pays out on borrowed finance. In the context of investment decisions, the rate of profit (or "rate of discount") is also a measure of expected capitalist income. Considerable confusion is created by reference to these rates indifferently as the "rate of time preference," a term which has meaning and acquires an independent conceptual status only in the context of the neoclassical theory of interest (or profits).

to that structure, to reveal its essential links, to expose its "internal logic." It follows that, if some of the links in that structure have now become unhinged at the level of the parable, this can only reflect back upon the base from which it derives its theoretical validity and in relation to which it has its heuristic value.<sup>1</sup> What is called into question also is the application of that structure, whether in the form of the parable or otherwise, to the study and analysis of any "real" capitalist economy.<sup>2</sup>

In general terms, the conceptual structure here referred to is one which conceives of the distribution of income in a capitalist economy as emerging from the pricing of goods and factors of production in a general equilibrium of competitive markets, the outcome being determined by the quantity of available factor endowments, the technology of production and the preferences of individuals.<sup>3</sup> Using Euler's theorem it can be shown, under well-known conditions, that the value of the output produced with those factors and estimated at the prevailing market prices is exhausted by distribution back to the factors in accordance with their marginal productivities. The owners of the factors receive an amount of income corresponding to the specified amounts of the factors

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<sup>1</sup>Some aspects of this line of reasoning are developed by Garegnani [1970].

<sup>2</sup>See, in this connection, Abramovitz and David [1973].

<sup>3</sup>As Solow ([1963], p. 14) puts it, ". . . the theory of capital is after all just a part of the fundamentally microeconomic theory of the allocation of resources, necessary to allow for the fact that commodities can be transformed into other commodities over time." For a restatement of this view in the light of the reswitching debate, see Bliss [1972].

which each owns times their productivities.<sup>1</sup> This set of relations emerges in a particularly simple and straightforward way, as shown in this paper, in the "one-commodity" model with two factors. Upon this set of formal relations, however simple or complex, neoclassical economists have sought to build a conception of factors of production, other than labor, or specific capital goods, as independently productive of value. Consistent with this conception, they have gone on to conceive of accumulation as a matter of the addition of new capital goods from the flow of current output to the pre-existing stock of capital goods, and hence as a matter of the time path of evolution of the stock of factors.<sup>2</sup> The capitalist firm is seen merely as an intermediary between the individuals as suppliers of factors from their pre-determined "endowments" of those factors and the individuals as rentiers engaged in arranging the pattern of their consumption over time by exchanging consumption "today" for consumption "tomorrow." The interest rate (or profit rate) is supposed to emerge from all this as a reflection on the one hand of the productivity of the capital goods and on the other of the presumed intertemporal preferences ("sacrifice") of the rentiers involved in refraining from consuming the current output of goods (or the existing stock).

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<sup>1</sup>These conditions apply only to the market for factors. The formal statement of the theory is completed by addition of markets, in the "present" and in the "future," for the flow of goods which are produced with those factors, some or all of which goods may themselves constitute the stock of factors, viewed as produced capital goods.

<sup>2</sup>This particular way of treating the problem of accumulation is exhibited with unusual clarity in Burmeister & Dobell [1970].

A conception which is central here and which the parable brings directly to the fore is that of capital goods as independently productive of value. This conception constitutes one blade of the scissors with which it had been thought possible to cut the connection which Marx had drawn between the existence of profits and the exploitation of labor and between these and the accumulation of capital as exchange value.<sup>1</sup> It is this conception which has now been shown to be without meaning and which must therefore be abandoned.<sup>2</sup> There is in general no analytical connection which can be drawn between the technical productivity of factors (capital goods) and the income which capitalists receive from the total product that would be consistent with the requirements of the neoclassical theory. That particular point having been made, attention can now be turned once again to those forces in capitalist society, operating at the level of the social relations of production, which account for the exploitation of labor and determine the share of income which capitalists receive. Consistent with this, the problem of accumulation and the role of capitalist firms can also be reformulated.

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<sup>1</sup>Cf. J.M. Clark ([1931], pp. 64-5): "The marginal theories of distribution were developed after Marx; their bearing on the doctrines of Marxian socialism is so striking as to suggest that the challenge of Marxism acted as a stimulus to the search for more satisfactory explanations. They undermine the basis of Marxian surplus value doctrine by basing value on utility instead of on labour cost and furnish a substitute for all forms of exploitation doctrine, Marxian or other, in the theory that all factors of production are not only productive but receive rewards based on their assignable contribution to the joint product."

<sup>2</sup>Lying behind this failure is a failure to conceive of the existence of social classes with a specific location in the production system. In neoclassical theory, society is conceived rather as an aggregation of particular individuals each with a particular vector of endowments and particular preferences.

It should then be possible to dispense with the other blade of the scissors represented by the conception of rentiers' intertemporal preferences as a determinant of the rate of profits.

Of course, in the formal statement of the equilibrium conditions of the neoclassical system, there still remains a condition of equality of the relative rentals of different factors and their relative marginal productivities or "marginal rates of transformation." As a condition for minimizing money costs of production in competitive factor markets, these marginal equalities must hold and hold rigorously.<sup>1</sup> Whether this condition contains an accurate description of the rules actually observed by capitalist firms faced with the problem of choice of technical methods of production can be debated. But that is a different matter.<sup>2</sup> The point is that this condition expresses, within the framework of this theory, only the criterion for cost-minimizing choice of technique subject to given prices of goods, given rentals of the factors and given technology. It cannot by itself provide any explanation of the determination of those rentals and prices.

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<sup>1</sup>Differentiability of the production functions describing the relation between inputs (factors) and output is not a necessary requirement for this condition to hold. With discreteness in the technology it can be reformulated in terms of marginal inequalities. All that is necessary is that the technology set be linear and convex in the neighborhood of an equilibrium point. The condition can be shown to hold, in particular, either in a model of production with discrete production processes (the "linear model of production") or in a model with smooth substitutability.

<sup>2</sup>Another matter for debate concerns the assumption of linearity in the technology (or constant returns to scale) under conditions of technical change. Little attention has been paid to this assumption in the recent debates. But in the context of a larger critique of the basic structure of neoclassical theory it is another damaging issue that was raised quite early by Sraffa [1926] and Young [1928]. For a recent return to this see Kaldor [1972].

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