Critique of the neoclassical theory of growth and distribution *

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1. Foreword

Any survey, concise as it may be, of the criticisms that have been made of the neoclassical theory of economic growth and income distribution requires that a distinction be made between its two basic components: economic growth and income distribution.

The theory of income distribution is the more traditional, but also the more controversial component of neoclassical theory. As such it is an integral part of that 'marginal revolution' that took place in the second part of the 19th century, in opposition to classical economic thought (of Smith, Malthus, Ricardo, Marx).

The theory of economic growth is more recent: it has been developed in the latter half of the 20th century, and had the effect of absorbing into the main stream of dominant (marginal) economic theory the ideas and insights of two 'Keynesian' economists (Roy Harrod and Evsey Domar), who had at long last revived interest in the 'classical' themes of long-run economic growth.

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The component concerning growth, when strictly considered, is not in itself a matter of substantial controversy, even if it remains open to various criticisms and objections. To simplify the matter to a certain extent, we might say that the neoclassical theory of economic growth, when making no use of the neoclassical theory of income distribution, is growth theory *tout court*. It extends in a certain direction the Harrod-Domar growth model, which constituted the starting point for *all* theories of economic growth (neoclassical and non-neoclassical) of the latter half of the 20th century.

In his survey of "Neoclassical theory of growth and distribution", published in this journal, Robert Solow has chosen to focus his contribution on the (less controversial) component, concerning economic growth. At the end of his article he says that "Very little has been said in this survey about income distribution" (Solow 2000, p. 378).

The present contribution, by contrast, will focus on the other component – income distribution, the one that has generated greater controversy.

2. The classical theory ('Ricardian' version)

The starting point, common to *all* economic theories of income distribution, can be traced back to the principal work of David Ricardo (*On the Principles of Political Economy and Taxation*, 1817), which may be taken as a synthesis of classical theory.[1] On the very opening page of his work, Ricardo sets forth the propositions:

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[1] *Historical note on the use of the term 'income distribution'. A*ccording to Edwin Cannan (1929, p. 293), the authoritative historian of economic thought, "both the word 'distribution' itself and the verb 'distribute' [...] were introduced into economic theory [...] by Quesnay", and thus by the French Physiocrats (in particular by Mirabeau, Turgot, Cantillon) in the latter part of the 18th century. Adam Smith followed the Physiocrats. "No English or Scotch economist seems to have made any technical use of the term distribution before Adam Smith produced the *Wealth of Nations*" (*ibid.*, p. 295). We may mention that a number of late 17th century statisticians, like Gregory King, Petty and Davenant made estimates of the incomes of the various British social classes, which indirectly recalls the phenomenon of distribution to our modern minds, but they never actually spoke of 'distribution'. On the other hand, Smith and the Physiocrats explicitly introduced and discussed the idea of 'distribution', although going no further than a few important remarks such as Smith's, that the value of any commodity must ultimately "resolve itself into" wages, profits and rents (see Smith [1776], 1904, vol. I, p. 54). An economic *theory* of income distribution was only to take shape as from the writings of David Ricardo (1817).

> "The produce of the earth – all that is derived from its surface by the united application of labour, machinery, and capital, is divided among three classes of the community; namely, the proprietor of the land, the owner of the stock or capital [...] and the labourers [...].
>
> But in different stages of society, the proportions of the whole produce of the earth which will be allotted to each of these classes, under the names of rent, profit, and wages, will be essentially different [...].
>
> To determine the laws which regulate this distribution, is the principal problem in Political Economy [...]" (Ricardo 1951, p. 5).

Ricardo had the genius to sum up in a complete and logically consistent scheme the debate that had been taking place among the British economists of his time. In particular, he succeeded in bringing together the core of the contributions to a famous exchange of views that emerged from a proliferation of pamphlets (by Malthus, West, Torrens and Ricardo himself), all of which appeared in February 1815. These pamphlets were prompted by the then imminent debate on the *Corn Laws* in the British Parliament, but they contain two theoretical benchmarks of decisive importance for all the ensuing debate: the differential theory of rent and "the law of diminishing returns", consequent upon the extension of cultivation of land. Both of these principles very strongly influenced all subsequent theories of income distribution and economic growth.

The differential theory of rent had already been anticipated by James Anderson as early as 1777, but had received scant attention. It was only through its association with the law of diminishing returns, in 1815, that the economic profession hailed it as a significant discovery. The merit, and the priority, must be attributed to Malthus (and probably to West). However, the differential theory of rent became associated with Ricardo's exposition and thus (albeit improperly) was termed 'Ricardian'.

In short, this theory singles out the origin of rent in the technical fact that different plots of land have different degrees of fertility, so that the more fertile plots yield their owners *differential* gains, with respect to the productivity of that (less fertile) plot of land which happens to be at the margin between cultivated and non-cultivated lands. It thus becomes crucial to identify this 'marginal' land, – i.e., that land which is the least productive but nevertheless must be culti-

vated in order to satisfy the total demand for agricultural produce. In any given situation, there will therefore be: a 'marginal' plot of land (which by definition yields no rent), extra-marginal plots of land – uncultivated because not fertile enough – and intra-marginal plots of land, which, besides being cultivated, also yield their owners certain gains (rents); these being the difference between the productivities of the (more fertile) plots of land and the productivity of the marginal land, which, though cultivated, yields no rent.

This is the more immediate, so-called 'extensive', version of the differential theory of rent. It was supplemented by an 'intensive' version, advanced by the same classical authors. Any plot of cultivated land which is more fertile than the 'marginal' land can also absorb additional doses of the other factors of production (capital and labour), to yield further produce, again with ever diminishing returns (though intensive, in this case). It will obviously be profitable to forge ahead with this (intensive) application until that point at which the differential gain (with respect to the marginal land) is reduced to zero. On the basis of this formulation, therefore, it is rent – in logical order – that represents the first part of the national product that reaches distribution. It is that part of the product that is appropriated by the land-owners.

In a classical social context characterised by three social classes – the land-owners, the wage-earners and the 'capitalists', who also act as the entrepreneurs in the production process – the *net* product of the economic system emerges as a 'surplus', that is obtained after replacing the means of production (which are considered as also including subsistence wages of the workers). Once rent has been distributed, what remains is to be subdivided between wages and profits. Now, in a natural-law dominated intellectual environment, impressed by the (then emerging) Malthusian theory of population, it is hardly surprising that Ricardo (and the classical economists in general) should be convinced that there exists a "natural" wage, just above subsistence, representing a family income at which the (average) population is induced neither to grow nor to diminish (stationary population). Once this (natural) wage has been distributed to the workers, the 'residual' represents the profits of the capitalists-entrepreneurs.

In rough outline, this is the celebrated theory of income distribution that Ricardo sets out in his *Principles*. Of course, his exposition is more complex and qualified, but its basic traits are essentially

these (a version of this theory, presented in mathematical terms, may be found in Pasinetti 1960).

The notable analytical characteristic of this Ricardian scheme is that, as soon as some notion of capital accumulation deriving from the capitalists' savings out of profits is introduced, this generates an endogenous process of economic growth. The mechanism is really simple: increasing capital induces an increasing demand for workers, which in turn causes wages to increase above subsistence. This (according to Malthusian theses) leads population to grow, making it necessary to extend the cultivation of land. If technology remains unchanged, then extending cultivation of land to the less fertile plots of land, or intensifying the exploitation of existing farmland, leads to diminishing returns as the quantities produced are increased. This in turn generates variations in the proportions of the national income distributed as rent, wages and profits. The total amount of wages (at the 'natural' level) can only grow in proportion to the number of workers. The differential productivity gains of the various types of land will also continue to increase as the marginal land keeps on being shifted further out. The total amount of rents will thus continue to increase. The hardest hit by this process will precisely be the members of that social class that Ricardo considered as the most active, namely the capitalists: the (residual) net national income remaining for profits will continue to diminish. Ultimately, there is no way out. The rate of profits will decline until it dries up all incentive to save (and to accumulate capital).

There are two channels that may counteract this trend. The first is external, and consists in international trade. If agricultural production (and with it diminishing returns) is left to the rest of the world, then home production can be concentrated on manufactures (for which returns to scale are constant or increasing), to be given in exchange for the food imports. The second channel is internal, and consists in improving the methods of cultivating land (i.e. technical progress). All the classical economists acknowledged the importance of improving technology. But, surprisingly, they underestimated its potential, convinced as they were that population growth would eventually outpace all the possibilities of boosting agricultural productivity, and that capital accumulation would ultimately come to a standstill, due to the "euthanasia" (to use a 'Keynesian' term) of the capitalists, left with negligible amounts of profits, i.e., too low incomes to

have any incentive to save and accumulate. The variation over time of the process of income distribution would thus lead to a 'stationary' state, in which the distribution of the income would essentially be reduced to only two relevant shares: wages for the workers (having reached the maximum number compatible with the existing natural resources, but constrained to a bare subsistence wage rate) and rents for the land-owners; the only class to become, and effectively remain, the well-to-do class.

We must acknowledge the impressive degree of clarity, completeness and, above all, logical consistency of this Ricardian formulation of the process of income distribution and economic growth.

Proposed at a time when economic theory was taking its first steps towards wielding analytic tools, this scheme had an irresistible fascination for the economic profession of the early 19th century. Yet, it implies a conception of the future of the then emerging industrial societies that is unjustifiably pessimistic, especially if we consider that it was proposed precisely at a stage in history when such an extraordinary process as the 'industrial revolution' was in full swing. Indeed, it is hardly surprisingly to find that it was the non-economists, rather than the economists, who recognised the undue pessimism of such a conception. A man of letters such as Thomas Carlyle, for example, had no hesitation in applying to this 'economic science' the oft-quoted epithet of "dismal science"!

3. The neoclassical theory of income distribution

The economists of the latter half of the 19th century had the intuition to grasp the ingenious potential of the marginal principle underlying Ricardo's theory of rent and conceived the idea of widening (or, rather, as is said more persuasively, of 'generalising') its application. That set of economic theories that were proposed in the late 19th century and were indicated as a 'marginal revolution' focussed precisely on the generalised application of the 'marginal principle'. This was introduced first to account for consumer behaviour (the theory of marginal utility); then it was applied, by extension, to the *whole* theory of production and distribution (and not only to land and rent).

This development is no doubt an interesting phenomenon, from the view point of the history of economic thought. It is a fact that the use of the marginal principle in the theory of production and distribution (later to become known as 'neoclassical' theory) did not come about as a result of new observations of reality. It came about by analogy, as a convenient, indeed as an elegant, aesthetically attractive, extension of Ricardo's principle of diminishing returns (originally concerning land) to all the resources in existence.

As industrialisation spread from Great Britain to the continent, the emphasis of economic theory naturally shifted from agricultural to industrial production. The accumulation of capital, much more than the extension of the cultivation of land, increasingly came to be at the centre of the economists' attention.

Eugen von Böhm-Bawerk, one of the major economists of capital theory, conceived of the accumulation of capital as a continuous increase of the indirect ("roundabout") methods of production, intended as a lengthening of the "period of production", while bringing about a substitution of capital for labour. In this version one takes on the marginal principle and the principle of diminishing returns in such a way as to make them indistinguishable parts of one and the same conception. It is important to note that this logical process of extension inevitably came to impose a series of analytic adaptations, which are not without consequences.

On the one hand, the marginal principle concerning land had to be moulded to fit the features of the other factors of production. This had the effect of actually restricting the Ricardian principle. More precisely, it had the effect of making the marginal principle applicable *solely* in its intensive version, i.e. in the form of returns that diminish at the *variation in the proportions*.

On the other hand, the application of the principle required the formulation of a series of assumptions which gave the other factors of production characteristics similar to those of land (in order for them to be treated, so to speak, *as if* they were land). The consequences of this 'assimilation' of capital to land, consummated for analytic purposes, proved to be unexpectedly fraught with serious consequences.

Knut Wicksell, the great Swedish economist, who provided perhaps the most rigorous version of the Böhm-Bawerkian theory of capital, early on became aware of numerous analytic difficulties (on which more will be said later). Nevertheless, he was among the first

economists to insert into a single 'production function' – which then became known as 'neoclassical' – *all* the factors of production (at first land and labour, later also capital), treating them all no longer – as Ricardo had done – according to a clearly defined hierarchical succession, but as being on exactly the same level and on perfectly symmetrical terms.

It is important to stress this well-defined order in the logical sequence in which the marginal principle was extended from land to the other factors of production. The principle was firstly, rather intuitively, extended from land to labour. Only later on, was it also extended to capital (see Wicksell 1934 and 1923). Indeed, even in the sixth edition of his celebrated *Economics* textbook, Paul Samuelson (1964, pp. 518 ff.) was expounding how "the principle of marginal physical product determines the distributive shares of income" in terms of only *two* factors of production: land and labour.

In these terms we may write the net national product (or national income) *(Y)* as a function – assumed to be continuous and differentiable – of land *(T)* and Labour *(L)*:

$$Y = F(T,L), \tag{1}$$

all the quantities being expressed in physical terms. The product will be distributed partly to the land-owners and partly to the labourers, in accordance with the obvious accounting relationship:

$$Y = rT + wL, \tag{2}$$

where r = rent per unit of land, and w = wage rate, both being expressed in terms of the physical product.

According to the marginal principle, if the production process is conducted by the land-owners, then the wage rate cannot exceed the marginal product of the labour unit, expressed by the partial derivative of Y with respect to L:

$$w \leq \partial Y/\partial L. \tag{3}$$

Similarly, if the production process were conducted by the workers, then the unit rent could not exceed the marginal product of a unit of land:

$$r \leq \partial Y/\partial T. \tag{4}$$

The distribution of the national product thus depends on *who* is conducting the production process, and thereby gets the residual. As may be realized, this does not appear a particularly elegant formulation.

But a mathematically-minded scholar will immediately notice that there is a particular case which immediately suggests itself for elegance. A theorem of Euler's states that, if function F were homogeneous and linear (i.e. of the first degree), then all asymmetry disappears since, in this case, the following equality would hold:

$$Y = (\partial Y/\partial T)\, T + (\partial Y/\partial L)\, L. \tag{5}$$

The temptation that naturally comes is to *assume* that F is precisely a function of this type, so as to make equality (5) satisfied and thus coincidental with (2).

If, moreover, we assume that function F is convex (i.e., its first derivatives are positive and its second derivatives are negative), the theoretical picture acquires even greater elegance. It turns out to imply constant returns to scale and diminishing returns to the variation of the proportions between the two factors of production (a process which can be interpreted as a phenomenon of substitution between the two factors). In this way any asymmetry disappears. Whoever be the entrepreneur (who maximises his own earnings), and whatever be the initial endowment of the production factors, a market with free competition will lead to such factors prices (i.e. to a wage rate and to a unit rent) which not only maximise the product, but also distribute to each factor of production precisely its physical marginal product, without leaving any (positive or negative) residual to anyone.

One might naturally think that such a scheme could be extended or (again with a deceptively convincing-sounding terminology) that it could be 'generalised' to any number of factors of production. In particular, one might think it rather natural to extend it to production with capital as a factor of production.

James Meade (1962) when formulating his version of neoclassical theory and of income distribution, set up a neoclassical production function precisely in terms of three factors: land (T), labour (L) and capital (K):

$$Y = F(T,L,K), \tag{6}$$

where F is supposed to be a linear, homogeneous (continuous and differentiable) function, which satisfies Euler's theorem:

$$Y = (\partial Y/\partial T)\, T + (\partial Y/\partial L)\, L + (\partial Y/\partial K)\, K, \tag{7}$$

so that the net product is distributed to rents, wages and profits without leaving any residual whatsoever. It is sufficient to add that the economic system is in a regime of perfect competition, whatever the initial endowment of factors of production may be, to enable the competitive price mechanism to lead the economic system to reach a point of equilibrium with full employment of all the factors of production, which will be both efficient and stable. For, given the assumptions made, the economic system generates inverse monotonic relations between the physical quantities of the various factors (T, L, K) and the corresponding returns per physical unit (r = rent, w = wage rate, π = rate of profits). The principle of substitution among factors of production will lead Euler's equation 7 and the accounting relation:

$$Y = rT + wL + \pi K \tag{8}$$

(where also the rate of profits now makes its appearance), to coincide with each other.

In the period between the two World Wars the stimuli, especially in the United States, to seek confirmation, or at any rate to proceed to empirical applications and tests, led to two new developments: 1) to return to focussing on only two factors of production, but now labour and capital (and no longer land!); 2) to adopt a specific mathematical formulation for the production function, so as to be able to carry out empirical elaborations on the data that were becoming available.

The mathematical function that gathered the most resounding success was the following:

$$Y = A\, L^{\alpha} K^{\beta}, \tag{9}$$

where A, α and β are parameters to be estimated and the sum $(\alpha + \beta)$ was expected to be equal to *1*, or in other words:

$$\beta = 1 - \alpha, \tag{10}$$

so as to make the function satisfy Euler's theorem. This function became known as the Cobb-Douglas production function, after the

names of the two American authors who used it (Cobb and Douglas 1928), although it had already been anticipated by Knut Wicksell in his review (reproduced in Wicksell 1934, p. 286) of a book by Dr Åkerman.

The interesting feature of (9) – as may readily be seen – is that, in conditions where the factors prices (i.e., w for labour and π for capital) are determined according to their marginal product (i.e., under conditions of free competition), parameter α comes to take up the meaning of the share of net national income that is distributed to wages, and parameter $\beta = (1 - \alpha)$ takes up the meaning of the share of net national income which is distributed to profits.

The two distributive shares emerge from the Cobb-Douglas function as technological constants. This means that any attempt to change them (for example, in the case they were thought to be undesirable) would imply interfering with the competitive price mechanism to which the efficiency of the economic system is entrusted.

4. Characteristics of the neoclassical theory

One cannot deny to this (neoclassical) theory of income distribution the fascination of formal analytical elegance, pleasing symmetry and also that sense of satisfaction that comes from the application of mathematical tools (which give a certain impression of being more 'scientific' than the plain prose exposition of the classical economists). Particularly attractive is the impression that the analytical tools have succeeded in representing an economic system with characteristics that satisfy both efficiency, from a technical point of view, and 'justice', from a distributive point of view. Behind it, the question of course remains open of the original distribution of the resources – capital and land – which are accepted as given. One might, however, think (as Meade did, quite explicitly) to confer to the public Authority the task of redistributing the available resources, in fulfilment of its social role. All this being said there can be no doubt that, as far as the distribution of the national income is concerned, the scenario appears quite satisfactory. In conditions of perfectly free competition, each factor of production finds full employment thanks to its infinite possibilities of substitution with the other factors of production, while, at the same time, receiving its marginal product,

which corresponds to its technical contribution to the production process. Furthermore, the scheme has the interesting trait of requiring no distinction between the marginal productivity of capital relevant to the single individual and the marginal productivity of capital relevant to society as a whole ('social' marginal productivity of capital). It was more or less in these terms that, in a series of papers published in the closing years of the 19th century, John Bates Clark championed this view of the neoclassical theory of income distribution (Clark 1894, 1899).

The extreme consequence of this approach can be seen for example in Schneider (1934), who applied the neoclassical production function, as formalised in (9), *at the level of the single firm*, and treated the model *as if* each firm effectively had available to it a continuous, differentiable, convex production function with all the possibilities of instant adaptation that are implicit in such formulation.

Of course, not all the neoclassical economists have been as naively enthusiastic as John Bates Clark or Erich Schneider. Yet, the widely held conviction has been that, despite its simplicity, the model could express important aspects of competitive economic reality.

To cite a few authoritative examples, James Meade in his presentation of the neoclassical model felt justified in stating:

> "It would be very desirable to allow for the existence of many different consumption goods and capital goods. [...] But I have a strong hunch that the main result would be not very substantially to alter the basic conclusions of the present analysis, but very greatly to increase the possibility of substitution between the various factors of production" (Meade, 1962, p. x).

Paul Samuelson in his turn, in the sixth edition of his celebrated *Economics* textbook, was confident enough to assert that:

> "[...] Clark's neoclassical theory of distribution, although simplified, is logically complete and a true picture of idealised competition" (Samuelson 1964, p. 526).

We must grant that Samuelson always played a leading role in the endeavour to extend John Bates Clark's theory to the general case. When multi-sector economic models began to be formulated in the economic literature, Samuelson (1962) presented an economic scheme with a plurality of capital goods which, as a whole, behaved exactly

like Clark's model. He presented his analytic construction with the aim of demonstrating that Clark's model proved a useful and significant 'parable', able to express the essential features of more complicated phenomena. His conjecture was that, complex as reality may be, it was basically such as would lead to the same outcomes as those depicted by John Bates Clark.

Robert Solow (1963), while extending his analysis to cases where the technological conditions are no longer so favourable as to give rise to continuous and perfectly differentiable production functions but give rise to discontinuities, was nevertheless convinced to have found in Irving Fisher's "rate of return" an expression for the gain that the economic system as a whole can derive from the application of a further dose of capital. In other words, he saw in Fisher's rate of return a modern expression – in terms of linear models with multiplicity of production techniques – of the more traditional notion of a social marginal product of capital. Neither Samuelson nor Solow realised at the outset, as will be pointed out in a moment, just how restrictive the assumptions would have to be in order that such conclusions may hold.

5. The emergence of a 'Keynesian' theory of income distribution, following the resumption of the theory of economic growth

It was the revival – after a century-long slumber – of the theory of economic growth (to which the classical economists had devoted so much attention, albeit with pessimistic views) that re-awakened the discussions of the theory of income distribution. With the explicit aim of extending Keynesian macroeconomic relationships to the long run, Harrod (1939 and 1948) discovered, and Domar (1946) then confirmed in more analytical terms, that, with reference to the industrialised economies where particularly relevant are becoming the two factors 'labour' and 'capital', a process of economic growth, in order to take place in dynamic equilibrium (*steady growth* with full employment), requires the fulfilment of a simple, interesting, but robust equation, namely:

$$g = s/v, \tag{11}$$

where g is the "natural" percentage rate of growth, s is the saving/net income ratio, and v is the capital/net income ratio. The "natural" growth rate was defined by the sum:

$$g = n + \lambda, \tag{12}$$

where n = percentage rate of growth of the working population and λ = rate of "neutral" technical progress (defined as the percentage rate of growth of labour productivity at constant v ratio, i.e. assuming that net product and total capital grow at exactly the same rate).

Equation 11 is a single equation but contains three magnitudes: g, s and v. Which of them can reasonably be considered as the unknown? Harrod took no stand on the matter. Inevitably, discussion swelled. Different theoreticians began to explore different avenues.

Nicholas Kaldor (1955-56) proposed a scenario of distinctly classical-Keynesian inspiration, which we might synthetically outline as follow: in an economic system in capitalistic expansion, up to the point at which a sufficient degree of primitive accumulation has been achieved, it is the rate of growth of the system, i.e. g – as in the classical models – that must be considered as the unknown magnitude in equation 11. Workers are available in practically unlimited quantities at a more or less constant wage rate, as in a typically classical conception. Thus it is technical constant v and the savings possibility of the economic system s that (endogenously) determine the rate of growth, according to a mechanism that had meanwhile also been pointed out by Arthur Lewis (1954).

However, according to Kaldor, once the accumulation of capital has absorbed the entire quantity of labour available, a second phase opens up. The growth rate of the economic system ceases to be determined by the share of income going to savings, and starts to be set by the possibilities of growth of the working population and of technological know-how, which become the bottleneck to the growth of the system. The consequence will be that wages will have to rise. In this second phase (of growth), the role of the unknown magnitude will be taken over by the saving/income ratio, s. But this magnitude is a composite one, as it can be considered as a weighted average of at least two propensities to save:

$$s = s_w\,(W/Y) + s_p\,(P/Y), \tag{13}$$

where s_w is the workers' average propensity to save, and s_p is the capitalists' average propensity to save, while W/Y and P/Y are the distributive shares of wages and profits, respectively. The simplest case is the classical one, where $s_w = 0$, i.e. where the workers save nothing, all savings of the economic system being carried out by the capitalists. It is immediately evident in this case that there is only one equilibrium rate of profits $\pi = (P/K)$, (which becomes the unknown):

$$\pi = g/s_p. \tag{14}$$

In this equation (which has become known as the 'Cambridge equation'), the causal chain goes from g (exogenous) to π (unknown). This equation has emerged as surprisingly robust (see the formulations of Pasinetti, 1962, that extends its validity to the case in which the workers' propensity to save is positive). It determines, through relation (13), the two distributive shares, in a logical sequence which is similar (but going in the opposite direction) to the 'Ricardian' one: first of all profits are determined and then, residually, wages.

The result has been a 'Kaldorian' theory of income distribution, which Kaldor himself has called "Keynesian". This theory confirms the classical idea of a basic asymmetry among the factors of production and, as a consequence, of the distribution of income, but it reverses its direction. It is the category of profits that is determined in the first instance, by the requirements of the accumulation necessary to sustain the given growth of the working population and the given growth of productivity. The category of wages then absorbs all the 'residual'. At the same time, Kaldor's vision (unlike the Classical one) appears as surprisingly optimistic. Once the requirements of accumulation are satisfied, all increases of productivity (i.e., all the fruits of technical progress!) translate themselves into an increase of wages, which over time will grow at exactly the same rate as productivity.

Actually, the idea underlying this theory of income distribution – the idea that it is accumulation, i.e. investments, that determine profits (and not *vice versa*) – had already been advanced in the 1930s by the Polish economist Michal Kalecki (1938 and 1942), within a social context in which he considered unemployment due to lack of effective demand. Kalecki had anticipated Kaldor and, in many ways, Keynes as well, but his ideas were not taken up.

One may ascribe to this line of thinking, at least in broad terms, also the ideas of Piero Sraffa, the Italian economist who had emigrated to Cambridge in the late 1920s and belonged to the group of economists who worked in close contact with Keynes.

Sraffa published in 1960, after a good thirty years' gestation, a truly notable book, short but extraordinarily compact and dense with ideas and insights. He had devoted virtually an entire life-time to prepare and publish the critical edition of Ricardo's works. In his book he presented a modern version of the Ricardian theory of rent both in the extensive and in the intensive form. By adopting a multi-sector production scheme, Sraffa resumed the classical conception of a global net production considered as a "surplus", that remains after the replacement of the means of production, and demonstrated how – within such a conception – income distribution takes place according to a process which, although more complicated than the one conceived by Ricardo, is nevertheless of the same type, i.e., it implies asymmetrical relationships. Rents arise from the technical non-uniformity of the available natural resources, as Ricardo had discovered from the outset. Therefore they do not enter into the determination of costs (and prices). They emerge as net differential gains for the owners of the technically more productive natural resources, as compared with the corresponding 'marginal' resources. They can thus be considered separately with respect to what is happening in the rest of the production process (in this connection, see the detailed analysis by Quadrio Curzio 1967 and 1997). As to profits and wages, i.e. to the two other distributive variables, Sraffa demonstrated that the economic scheme of production is not in itself able to determine them both (contrary to the tenets of the neoclassical theorists). One of these two distributive variables – either profits or wages – cannot but be determined by relationships that are exogenous to the production process. As will be remembered, Ricardo (with all the classical economists) had posed the problem precisely in these terms. He had thought of an external determination of wages. By contrast, Sraffa (like Kaldor) singled out the rate of profits as the variable to be determined exogenously to the production process. Sraffa did not however subscribe to the Kaldorian theory (though not explicitly rejecting it, nor denying its compatibility with his own scheme). What he rather did stress was that various alternative channels might be taken into consideration. He mentioned, by way of example, the processes underlying the de-

termination of the rate of interest in the financial markets (thereby coming closer to the ideas of Keynes's than to those of Kaldor's).

In any case, Sraffa most important contribution was to open up the issue of the determination of the rate of profits – and, with it, the whole problem of income distribution – to an investigation that did not stop short at purely economic considerations but would go beyond them, up to including the entire institutional organisation of an economic system, as a subject of analysis, in order to achieve a satisfactory explanation of the phenomenon of income distribution.

Unfortunately, after an initial period of – possibly even excessive – enthusiasm, Sraffa's formulations concerning income distribution were, like those of Kalecki's, either forgotten or left on the sideline of the economists' attention.

6. Return to the neoclassical theory

In the meantime, there has been, instead, a surprising revival of neoclassical theory.

In the interpretation of the Harrod-Domar equation there is in fact a third possible line that may be taken. Equation 11 contains a third magnitude, v – the technological magnitude. Neoclassical economists interpreted it as if, in the Harrod-Domar model, it represented the "case of fixed coefficients". And since v itself cannot be considered as fixed, it sounded obvious that precisely v should be the appropriate magnitude to be taken as the unknown in equation 11.

In a well-known article in 1956 (p. 66), Solow explicitly stated the intention to propose a model "that accepts all the assumptions of Harrod-Domar except that of fixed proportions" among the factors. In effect, however, he did add many other assumptions that had not been made by Harrod and Domar. Solow introduced the existence of a neoclassical production function with the factors 'labour' and 'capital' as its arguments:

$$Y = F(K, L), \tag{15}$$

which had all the characteristics described in Section 3 above. It is easy to demonstrate that, thus interpreted, the Harrod-Domar equa-

tion – with g and s fixed – generates an equilibrium solution with full employment of the two production factors K and L, whatever be their initial endowments (thanks to the infinite possibilities of substitution between capital and labour, implicit in the neoclassical production function), and with ideal equalities of factor returns and corresponding marginal productivities. If the working population increases at growth rate n, and capital increases by a fixed proportion, s, of the net national product, then the inverse monotonic relationships between factors prices and respective physical quantities will ensure convergence of the economic system to a stable long-run dynamic path along which the Harrod-Domar equation is always satisfied. Solow had in this way resumed the neoclassical theory of income distribution and had grafted it onto the Harrod-Domar model of economic growth. (A similar exercise was independently done by Swan 1956.)

Things grew somewhat more complex with the Harrodian preoccupation concerning technical progress. In Harrod's model the introduction of technical progress appears, in a very simple and natural way, as an increase, at the same percentage rate, of *per capita* capital and of *per capita* net product. In the neoclassical model, on the other hand, because of the supposed perfect symmetry among the factors of production (externally imposed, as we argued above), the introduction of a variation in technical know-how gives rise to the possibility of conceiving of technical progress in three different ways, according to whether it is seen as increasing the productivity of labour (*labour-augmenting*), or as increasing the productivity of capital (*capital-augmenting*), or as increasing the productivity of the whole function F. To each of these three types of technical progress, there corresponds a particular notion of "neutrality". These three different types of neutrality have become known as "Harrod neutrality" (which implies *per capita* production increasing with a constant capital/income ratio), "Solow neutrality" (which implies increasing production per physical unit of capital, with a constant labour/income ratio) and "Hicks neutrality" (which implies increasing physical productivities of both factors, with an unchanging ratio between their marginal productivities).

All this may sound rather complicated, but it lends itself to a truly elegant mathematical exposition, which seems to convey a sense of wide generality. Harrod's case would appear to be as one of three

possible particular cases. The fact is, however, that the case of technical progress *à la* Harrod known as "labour-augmenting" (and presented in Harrod's exposition as the most obvious, simple and natural case) actually turns out to be the only one compatible with long-run growth at a steady rate. The two other types of neutrality do not in general lead to any regular or in any case to any interesting dynamic trend.

It has however been discovered that in the very particular case of a production function of the Cobb-Douglas type, all three types of neutrality (this is another of the wonders of the Cobb-Douglas function!) can be represented by *exactly the same analytical expression*, although the interpretation of its parameters would have to be different in each of the three cases. In other words, all three cases can be reduced to the single case of "neutrality" (Harrod's case), relevant for equilibrium growth at a steady growth rate (see in this connection, Allen 1967, ch. 13).

From the 1970s onward, it has been the neoclassical theory of distribution, grafted on the Harrod-Domar growth model, that has received the widest consensus in dominant economic literature, especially, and not surprisingly, with an almost general use of the Cobb-Douglas production function.

The following section is devoted to a severe critique of this theoretical development.

7. Critique of the neoclassical production function

It is only appropriate to stress that the particular production function of the Cobb-Douglas type was proposed in the 1920s and 1930s in order to be able to carry out empirical elaborations by taking advantage of the data then becoming available: on production, on labour, on capital. It is of course quite understandable that, when using aggregate data, one may resort to some sort of simplification and approximation. But within which margins is this justifiable? Those who made the original investigations presented them with great satisfaction (Cobb and Douglas 1928, Douglas 1934). But the interpretation of their findings continued to face hails of criticisms. In a recent article, Sylos Labini (1995) has presented a survey of the

empirical applications that have been carried out with use of the Cobb-Douglas production function since the 1930s up to the present day. He has been compelled to draw decidedly negative conclusions.

Suffice it to mention that, in the overwhelming majority of cases, the sum of the two parameters *(α* and *β)*, which should represent the distributive shares, come out to be decidedly far from unity; in some cases the parameters even turn out to be negative! – an obvious contradiction. And yet, to rid themselves of this contradiction, what the researchers have done has simply been to introduce a further assumption which would eliminate the contradiction. They simply introduced the constraint that the sum *(α + β)* be equal to unity; and then proceeded to empirical estimates after having imposed such a constraint, thereby entirely foregoing any 'explanation' of the distributive shares. Yet, since by so doing, equation 3 comes to coincide, *ex hypothesi*, with accounting relation 2, it no longer is an independent equation deriving from a production function.[2] One must at least admit that its parameters must be left open to other (alternative) interpretations (consider, for example, the much more plausible interpretation proposed by Sylos Labini 1995).

Indeed, if these are the results, one cannot at least repress the suspicion that something deeper is not properly 'functioning' in the neoclassical production function.

Ever since the original formulation of the neoclassical theory of income distribution, the major criticisms have been directed toward the treatment of capital. A notable survey of the way in which capital has been treated in the theories of income distribution has been presented by Garegnani (1960 and 1990). He has carried out a punctilious historical critique, reaching conclusions that are entirely negative for the neoclassical distribution theories. Not all his criticisms may be equally convincing, but his basic arguments are hard to confute.

Basically, the major shortcoming of neoclassical theory is that of enforcing a perfect symmetry between the treatment of 'labour' and the treatment of 'capital', a feature suggested by the criterion of mathematical elegance, but which finds no support either in reality or

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[2] See the extremely interesting exercise carried out by Anwar Shaikh (1974), showing how *any* arbitrarily chosen set of data – even data points spelling out the word 'HAMBUG'! – can perfectly be fitted by a Cobb Douglas production function with marginal productivities always being equal to the corresponding 'factor prices', when equation 3 ceases to be an independent equation.

in logic. It is a fact that, for basically conceptual reasons, the two factors are *not* symmetrical to each other. Labour can be expressed in physical terms (let us say in hours, or days of work) to which its reward – the unit wage rate – is referred (wage per hour, or per day or per month of work). Capital must of course also be expressed in physical terms (let us say number of machines, for example, or an index of its physical quantity), when inserted into any production function. But its reward (the rate of profits), i.e. what is relevant for the purposes of a theory of income distribution, is *not* commensurate to its physical quantity, but rather to its value (i.e., to its physical quantity multiplied by its price; and this price – like all prices – is in turn dependent on the rate of profits). In the case of a model with a single good (and only in this case), physical quantity and value happen to coincide, since the price of the product and the price of capital is the same price, *ex hypothesi*. In this case the asymmetry is not visible. The neoclassical production function (in this case, and *only* in this case) shows no logical inconsistency. But, as soon as we go over to the case of even a mere two-good model (e.g. one consumption good and one capital good); the neoclassical production function (6) is no longer logically consistent. There are two possibilities: either we use the symbol K to represent the physical quantity of capital (in which case the partial derivative $\partial Y/\partial K$ no longer represents the rate of profits but the rental of capital, which in turn is to be multiplied by the price of the capital good); or else we stick to the use of symbol K to represent the current value of capital, but in this case the partial derivative of Y with respect to K emerges as being the sum of two addends, one representing the variation in the physical quantity of capital, the other representing the variation in the price of such a physical quantity.

The Swedish economist Knut Wicksell (1901) became aware of this circumstance quite early, and with exemplary coherence always chose to include, in his production functions, capital measured in physical terms, which was then multiplied by the corresponding price, before being used as the argument of the derivative that represents the marginal product of capital. However Wicksell also immediately realised that, by so doing, the marginal product of capital can never be equal (except by some extraordinary coincidence) to the rate of profits (which he took to coincide with the rate of interest). Indeed his conclusion was that the marginal product of capital always turns

out to be smaller than the rate of profits, because the variation of capital leads to changes in its price, i.e. to changes of the (current) unit in terms of which capital itself is measured. The divergence of the marginal product of capital from the rate of profits came to be known as the *Wicksell effect*.

An interesting development of this argument came about when, in a subsequent discussion with Dr Åkerman, Wicksell (1923) did confirm his previous finding of a divergence between the rate of profits and the marginal product of capital, but at the same time also realised, to his surprise, that not always did the divergence occur in the same direction. It could in certain cases – as he had always thought – be negative (the *Wicksell effect*), but it could also in other cases turn out to be positive, generating a *Wicksell effect* in reverse.

The consequences of Wicksell's analyses for the marginal theory of capital are very serious. But it was by then too late for the Swedish economist himself to be able to go into them in detail.

We may ask: if the marginal product of capital and the rate of profits prove not to be monotonically related to each other, what significant role can there be for the very concept of 'marginal productivity of capital'? It is precisely this question that has been at the basis of the controversy in the theory of capital, in the 1950s and 1960s, a controversy which at times grew quite heated.

For exposition clarity, we may distinguish the debate into two phases. The first phase began with a vehement attack launched by Joan Robinson (and to some extent also by Nicholas Kaldor and Richard Kahn) on the very concept of 'neoclassical production function'. By and large Joan Robinson (1953-54) started from Wicksell's findings and proposed to consider a technology no longer consisting of a continuum of production techniques, but rather of a finite number of techniques that can be combined two at a time in a linear relationship. She concentrated her critique on the concept of 'capital', as a factor of production. What meaning can be ascribed, she asked, to a factor capital, K, which is inserted into a neoclassical production function if, when expressed in value terms, this magnitude is no longer independent of the rate of profits and thus of income distribution?

The ensuing debate waxed profuse and lively, beginning with a well-known article by Solow (1955-56). An important aspect of this discussion was to clarify the conditions that have to be satisfied for

heterogeneous capital goods to be susceptible of being aggregated as a single physical quantity. Emblematic in this respect are the article by Samuelson (1962), on the "surrogate production function", and the proposal made by Champernowne (1953-54) concerning the construction of a "chain index" for aggregating the capital goods which follow one another in a process of variation of production techniques as income distribution is changing. The conclusions reached on the matter (see also Franklin Fisher 1971) may be summed up in the following proposition: the conditions to be satisfied in order to aggregate heterogeneous capital goods are so extraordinarily restrictive as to rule out any reasonable possibility of constructing an aggregate physical measure of capital goods.

While acknowledging the forcefulness of this proposition, the neoclassical economists offered a general defence of capital aggregation procedures by pointing out that the total quantities of labour and of net national product are also obtained by aggregating heterogeneous quantities. When, for the sake of simplicity, one resorts to aggregation, much the same problems arise for labour and for the net national product as they arise for capital. Of course, this is true. But a fundamental point has been overlooked (and the discussion on aggregation may have contributed to diverting attention from this important point). The problem that arises in the case of capital has not so much to do with the difficulty of finding practical means to carry out aggregation with a fair degree of approximation; it is more fundamentally the conceptual difficulty of having to treat an aggregate quantity expressed in value terms (capital) in the same way as other aggregate quantities (land and labour) which are instead expressed in physical terms. The two types of aggregate quantities do not belong to the same logical class, and can thus neither be placed on the same level nor be inserted symmetrically in the same function. This is no longer a matter of a more or less appropriate degree of approximation. It becomes a fundamental and indeed abyssal conceptual diversity concerning the 'factors' labour and land on the one hand, and the 'factor' capital on the other.

It is precisely on this problem that a little more light was cast during a second phase of the debate, which was prompted by the appearance of a very short, and initially totally ignored, chapter relegated to the end of Piero Sraffa's book (1960).

Sraffa pointed out that, in a multi-sector production scheme, the production techniques that are chosen as the most profitable ones, as variations take place in income distribution between profits and wages, do not follow each other in an unambiguous and unchanging order. Whatever convention may be adopted to 'measure' the capital that is used, the production techniques that require a high proportion of capital to labour at a low rate of profits may well be discarded by other (more profitable) techniques when the rate of profits is higher. But the former production techniques may once again become the most profitable techniques at even higher rates of profit. Known as the "re-switching of techniques", this phenomenon went virtually unnoticed when Sraffa's work was published, but was brought to the limelight by a series of contributions forming a "Symposium" edited by Samuelson in 1966, and stimulated by the opening article of such "Symposium", written by Pasinetti (1966) as a criticism of a previous article by Levhari (1965). The Symposium was followed by a copious literature (well reviewed in a survey by Harcourt 1969, 1972).

The main theoretical finding of these contributions is that in general there is no inverse monotonic relation between quantity of capital (whatever the method chosen for its measurement, whether in physical or in value terms) and rate of profits – a phenomenon also known as *reverse capital-deepening*. This basic proposition, which is applicable both to the economic system as a whole and to the individual productive processes, still remains valid, despite the almighty efforts of hosts of neoclassical economists to confute it, or attenuate it, or to limit its scope.

The "Symposium" contributors were well aware of the theoretical implications of these findings, which are devastating for the neoclassical theory of income distribution, since they deprive of any general applicability that relationship – assumed (let it be remembered) through extension and analogy rather than prompted by observation! – between the price of the 'factor' capital and the corresponding quantity, whatever way is chosen to measure it. This is a property that had been taken, since the beginning, as general and characteristic of all relations of traditional economic theory.

Paul Samuelson thus summed up the conclusion to the "Symposium":

> "[...] the phenomenon of switching [...] of techniques [...] shows that the simple tale told by Jevons, Böhm-Bawerk, Wicksell and other neoclassical writers – alleging that as the rate of interest falls in consequence of abstention from present consumption, in favor of future, technology must become in some sense more roundabout, more 'mechanized', and 'more productive' – cannot be universally valid [...].
>
> [...] There often turns out to be no unambiguous way of characterizing different processes as more 'capital intensive' [...].
>
> [...] If all this causes headaches for those nostalgic for the old time parables of neoclassical writing, we must remind ourselves that scholars are not born to live an easy existence. We must respect, and appraise, the fact of life" (Samuelson, 1966b, pp. 568, 582-83).

Charles Ferguson (1969), in a book dealing specifically with the neoclassical theory of production and income distribution, concluded by reiterating Samuelson's propositions:

> "[...] the Cambridge Criticism definitely shows that there may be structures of production in which the Clark parable may not hold [...]. The crux of the matter is that economists may be unable to make any statements concerning the relation of production to competitive input and output markets.
>
> I believe they can; but that is a statement of faith [...]" (Ferguson 1969, p. 269).

A statement of faith! How could it be accepted? Clearly, the matter could not be left in such terms, or at least it could not be left in such terms in an explicit way.

It is worth recalling that a science methodologist (Thomas Kuhn 1962) has taught us that it is no rare event in the history of science that now and then findings are obtained that clash with the accepted theory, or predominant 'paradigm'. The most common response in such cases (until a new, more satisfactory 'paradigm' emerges) is simply to disregard the 'anomalous' findings.

In the subsequent years, this is precisely what has happened.

8. 'Repression' of *re-switching* in dominant economic literature

After the stirring, contentious debate over the theory of capital generated by the discovery of the phenomenon of *re-switching* in the 1960s, one has surprisingly witnessed, in the economic literature, within the course of only a few years, the sudden, one might even say abrupt, disappearance of all discussions on such themes.

The phases through which this state of affairs has come about are themselves an interesting phenomenon, from the viewpoint of the history of economic science, and deserve careful consideration, even at the cost of a brief digression.

The first reaction to the discovery of *re-switching* was one of uneasy fastidiousness. The intuitive conjecture prevailed that it should be an odd, weird, bizarre or rare case of no empirical relevance whatsoever. The economists who nevertheless originally had to admit it did so with instinctive reluctance, as it clashed with their inherited way of thinking. They used a variety of terms for it, ranging from "paradoxical" and "perverse" to "exceptional", "inconvenient" and "anomalous"; a case that "[...] intuition suggests is unrealistic", and so on (see the numerous quotations in Pasinetti 1966, p. 515, and also Pasinetti 1978). Charles Ferguson, as reported above, was more explicit and candid. He reasserted his instinctive confidence in the neoclassical production function, but admitted that his trust was "a statement of faith".

There followed a second phase in which there was a painstaking search for specifying the conditions that could be sufficient to exclude the re-switching phenomenon (on the subject see, for example, Franklin Fisher 1971, Sato 1974, Burmeister 1980). There was moreover a substantial effort to re-interpret the rate of interest as at least expressing the rate of return for society as a whole, when the economic system was changing the proportions between two equally profitable techniques (Solow 1963 and 1967). However, all these efforts did not lead very far. On the one hand the conditions that would be needed in order to avoid the *re-switching* of techniques proved to be so extremely restrictive as to leave no reasonable possibility of relying on them. On the other hand, in a critique of Solow's attempt to revive Irving Fisher's concept of the "rate of return", Pasinetti investigated a general discontinuity property of the conception of spectrum of tech-

niques, showing that the vicinity, even an infinitesimal vicinity, of any two techniques on the scale of variation of the rate of profits does not entail at all any vicinity of such techniques (as marginal productivity theory would require) on the scale of variation of their degree of capital-intensity (capital/output, or capital/labour ratios). Capital-intensity might in fact remain quite far apart for the two techniques involved (Pasinetti 1969). These discontinuity properties have been analysed in detail by J. Barkley Rosser Jr (1991, ch. 8: "Discontinuity and capital theory"). Thus, new analytical investigation could bring no help for the traditional views; quite the contrary.

Yet there finally came a third very curious phase, which should appear rather strange, given its weak theoretical and empirical underpinning, but which was greeted with relief by the theorists of mainstream economics. The essence of this third phase can be summed up with the following proposition: the criticisms of the traditional theory of capital raised by the phenomenon of *re-switching* (and consequent *reverse capital-deepening*) are valid, but only with reference to the neoclassical model conceived in aggregate terms. They do not apply to the neoclassical case of the general economic equilibrium model, conceived in disaggregated terms and based on the behaviour of individuals maximising inter-temporal functions of profits and of utility.

This proposition actually has no objective foundation: phenomena of non-convexity, re-switching of techniques and *badly-behaved* production functions, to take an expression that has been widely used ("behaving badly" meaning simply that they behave in a way as not to obey the assumptions of neoclassical economics), are not – as has been amply demonstrated – a consequence or a characteristic of any particular process of 'aggregation'. They may occur at any time and in any context, aggregated or disaggregated. Various authors have continued to demonstrate this point (e.g. Kurz 1987, Schefold 1997, Garegnani 2000, and others). But so things go. The contrary conviction had taken root and has continued to spread. Above all, the proposition cited above has been trundled out again and again, with no proof, but simply referring back to other sources, which in turn are either insufficient or inconsistent.

The principal one of these sources is represented by an incredibly polemical and dogmatic paper by Frank Hahn (1982), explicitly intended to heap discredit on those economists whom he calls "the

Neo-Ricardians". With undeniable rhetorical and dialectical skill, Hahn shifted the bases of the whole debate. He admits, without mincing words, that the entire version of neoclassical theory of capital and income distribution, based on aggregate production functions (basically, the whole neoclassical stream of thought descending from Böhm-Bawerk, Wicksell and John Bates Clark) has to be scrapped as inconsistent and incorrect. He then goes on to argue that the correct and relevant version of the neoclassical theory is not that of Böhm-Bawerk, Wicksell and Clark, and not even that of Marshall, but rather the theory that stems from the Walrasian scheme of general economic equilibrium; a scheme which in its modern version is represented by the Arrow-Debreu formulation (Arrow and Debreu 1954, Debreu 1959, Arrow and Hahn 1971). In this version, the scheme appears as a very general one. Although, in its essential terms, the scheme is a pure exchange model (i.e., a scheme of given resources, which the 'agents' exchange among themselves on the basis of the postulate of maximisation of utility), it can also be reinterpreted in inter-temporal terms, by associating with each resource a quantity index and a time index. In this version, the phenomenon of production becomes a phenomenon of inter-temporal exchange. Thus a framework can be traced out containing a whole range of heterogeneous capital goods. At any given moment of time, the postulates of maximisation (of utility and of profit) by the 'agents' (consumers and entrepreneurs) lead the system to positions of 'temporary equilibrium', generating an overall system of prices for all resources, present and future.

According to Hahn, this framework also includes Sraffa's model as a very special case; namely, as the case where the original heterogeneous goods in the given initial set are exactly in those proportions that generate a uniform rate of profits. But, in general, the 'equilibrium prices' generated by the system will imply rates of interest (and of profit, taken to coincide with the rates of interest) differing from any one (heterogeneous) capital good to another. This does not matter in the Walrasian model *à la* Arrow-Debreu, given that this model is a price determining model (a point which will be taken up again in the following section). Indeed, the non-uniformity of interest rates is proudly pointed out as a sign of the generality of the model. Hahn admits that the framework might show cases and problems of lack of uniqueness and/or lack of stability of the solutions. However, Hahn

claims that the scheme should be immune to the criticisms prompted by the *re-switching* phenomenon.

But how? The point is precisely here. According to Hahn, in a system with manifold production techniques, equality would still hold between the return on each capital good and the derivative of its production with respect to its input, namely the 'marginal productivities' (in physical terms), although no causal relation could ever be asserted, since all the solutions emerge from a system of simultaneous equations. Hahn admits that there might, of course, be some "non-convexities" and "badly-behaved" production functions, in other words that cases of *re-switching* might occur. So Hahn admits cases of *re-switching* after all! But here is the ruse: while admitting such cases, Hahn relegates them to the category of difficulties concerning the zones of 'instability'. Now, zones of instability of the system can always occur, in models with heterogeneous capital goods, even in the case of perfectly convex and *well-behaved* production functions. Indeed, Hahn himself had demonstrated precisely this in an earlier article of his (1966) – an article, it is to be noted, written as a critique of dominant theory. Here is therefore how the confusion has been generated – a confusion between two different phenomena, namely: *a*) instabilities, that can in general arise in all neoclassical models with heterogeneous capital goods, and *b*) the particular phenomenon of *re-switching*, which – by being re-classified as generating instability (a characteristic which is not incorrect, since, among other things, *re-switching* also generates instability in the capital goods market) – is restrictively associated (and confused) with the case previously considered by Hahn.

The paradoxical outcome has been that, instead of taking up Hahn's first finding (1966), which is critical and negative with reference to all the multi-sector models of neoclassical theory, mainstream literature has used Hahn's second article (1982) to assert that the difficulties connected with instability were already well-known.

Conclusion: *re-switching* had nothing new to tell us. As if the difficulties, when they are already known could, by this very fact, acquire a justification for being ignored, no matter whether they crop up in another context, where they are reiterated and extended! Surprisingly enough, however, this is precisely what has happened.

Hahn has certainly been very careful not to stress his previous findings – strictly logical and negative. Instead, he has adopted the fa-

miliar expedient of saying that, of course, there are difficulties; of course these difficulties call for further research; hopefully further research will settle them in the future.

And here we finally come to the *non sequitur* of the conclusion: the "Neo-Ricardians" could safely be ignored.

Mainstream economists could not have asked for better. The effect has been to give *re-switching* the air of an obsession vexing others, and to induce dominant economic theorists not to talk of it any more. The debate soon flagged; in the major economics journal it has been forgotten.

But something even more interesting and intriguing has happened. After only a few years, even the admissions initially made no longer found any mention. *Aggregate* production functions have made their untroubled re-appearance in the macroeconomic textbooks, without the slightest hint as to their earlier (recognised) logical inconsistencies. It has taken only a few years for them to reappear in papers published in the major journals of dominant economic theory, which at the same time have begun systematically to reject all articles dealing with *re-switching* as unpublishable. The same authors, who had for two decades been asserting the need to scrap the aggregate neoclassical production functions are now using them quite normally. The typical economics student entering university from the 1980s onwards has heard nothing of the *re-switching* difficulties involved in the neoclassical theory of capital and income distribution.

It is *as if* the debate on the choice of techniques had never taken place. Amnesia on such a vast scale can only be explained by more appropriate terms, such as 'suppression' or 'repression' or 'removal'. This is, perhaps, one of the most interesting examples of that process described by Kuhn (1962), through which dominant 'normal' science suppresses, and thus ignores, the cases of contradiction and anomaly it bears within.

9. Consequences for the theory of income distribution

The 'removal' of the *re-switching* phenomenon from the debates on economic theory, jointly with the dismissal of all emphasis associated with the theory of capital and at the same time the promotion of the

Walrasian theoretical scheme in the Arrow-Debreu version to a place of privilege in economic theory have not been neutral events in the development of economic theory. They have practically caused the disappearance of the analysis of the problems of income distribution from the topics of discussions of neoclassical economic theory and policy.

It is worth pointing out that this outcome is another logical consequence of the choice made by dominant economic theory to abandon the formulations of the classical economists and to give pre-eminence to the Walrasian logical scheme *à la* Arrow-Debreu. It is important to realize that this logical scheme has acquired elegance and rigour by performing a number of 'generalisations' that are purely formal reinterpretations. This scheme traces all economic problems back to one single basic problem, namely that of identifying a system of prices which is associated with an optimal allocation of existing resources, relative to: 1) the preferences of individuals, which are expressed by utility functions (having certain specific characteristics assumed as given); 2) an initial distribution (accepted as arbitrarily given) of the existing resources. The scheme might well also be considered as an elegant extension to all economic phenomena of the original Ricardian theory of rent. All prices are in fact interpreted as *rent*-prices.

In this scheme there is no problem of income distribution as such. There exists an initial distribution of resources, entirely arbitrary and accepted as given (and not subject to any explanation or investigation), and what is being sought is an optimal system of prices of these resources. The theory is essentially, and solely, a theory of prices. From an analytical point of view, every phenomenon must be re-shaped as something that may be presented as a 'given' resource in order to arrive to the determination of its price. The specific characteristics of profits, of wages and of rents that had so deeply marked the concern of the classical economists do not exist as such. The scheme possesses such elegantly generalising features that – thanks to a process of formal re-interpretation of its constitutive elements – it reduces all economic variables essentially to a system of rent-prices. All the rest takes up a decidedly secondary role.

To return to the configuration, mentioned in the previous section, of a reinterpretation of the heterogeneous capital goods as part of a phenomenon of exchange through time, the Walrasian scheme

determines the series of prices of the capital goods existing at a certain point in time, the series of their rentals and the series of the prices of the new capital goods that are produced. There is nothing else, outside these prices. On the basis of these elements, it is also possible to compute, logically, as derived concepts, the corresponding (heterogeneous) rates of profit. But these are, as just said, derived concepts, not constitutive concepts. The scheme does not require their specific introduction. The rates of profit in this way come to constitute secondary elements. They are the fruit of re-reinterpretation and as such they become, ultimately, irrelevant concepts.

A somewhat similar line of reasoning can be developed for 'wages', which again are not specific elements of the model. They are themselves part of the various 'prices'. They become the 'prices' of the labour-resources, and are to be treated in a manner similar and symmetrical to the prices of all the other resources.

To sum up, the neoclassical scheme, in the Arrow-Debreu version, needs neither rates of profit nor wage rates as such. It determines 'prices' of given 'resources', and only 'prices'. To find a place in this framework of analysis, any economic phenomenon must be remoulded and re-interpreted in these terms.

With this conceptual framework, the shift of dominant economic theory in the direction of the neoclassical version descending from the Arrow-Debreu scheme has practically entailed a general escape of economic analysis from the investigation and explanation of the problems of the distribution of income (and of wealth).

At the dawn of classical economic theory, David Ricardo in 1817 opened his *Principles* with the famous proposition quoted at the beginning that "To determine the laws which regulate this distribution [of income between rent, profit and wages] is the principal problem in Political Economy". At the end of the 20th century, dominant economic theory has ended up with a theoretical framework (the neoclassical one, in the Arrow-Debreu version), where the process and problems of income distribution have become secondary and, essentially, irrelevant.

10. Growth without problems of income distribution in the models with endogenous technical progress

Despite the pre-eminence and privilege accorded by dominant economic literature to the – fundamentally static – logical scheme of Arrow and Debreu, the problems of economic growth and technical progress have not taken long to crop up again. A strong revival of economic growth theory was briskly rekindled in the 1980s, as a result of various attempts to grapple with a real and undeniably important problem. Investigation has been turned to the question of how technical progress may not only be received from external sources, but could itself be *produced* by an economic activity explicitly targeted on it. The problem is interesting, but also complicated, given the peculiar properties of technical know-how, which is only artificially and temporarily subject to property rights and indeed shows characteristics closer to those of non-exclusive public goods.

Growth models with *endogenous* technical progress thus saw the light of day. It was inevitable that, to be successful, initial research on endogenous technical progress should begin in the universities of the United States. Ten years had elapsed since the difficulties of neoclassical capital theory due to *re-switching* had been 'repressed' and forced out of economic debate, and so withdrawn from the attention of the new generations of scholars. With no recollection of the earlier debate, it was only natural that the new formulations should be grafted on to the dominant neoclassical stream of thought.

The growth models with endogenous technical progress that have emerged are extraordinarily refined in terms of the analytical tools used and at the same time naively simplistic in their vision of the world. Basically, using few but fascinating elegant analytical tools, they offer a re-edition and a restrictive re-adaptation of a mathematical model of inter-temporal maximisation which Frank Ramsey, a young mathematician in Keynes's Cambridge group, had proposed in 1928. His model was in fact conceived as an exercise in bringing out the analytical properties of a hypothetical economic system where an omniscient central planner, endowed with eternal life, decides on the distribution of production and consumption over time for all his subjects, being himself acquainted with all their preferences and all the constraints imposed by the technical conditions.

But the authors of the growth model with endogenous technical progress have had greater ambitions, aiming at providing a *descriptive* scheme of the real world, and it is here that they have shown surprising naivety. None have had any hesitation in using neoclassical *aggregate*, continuous and differentiable production functions of the very type for which abandonment had been advocated twenty years earlier. None felt the need to justify or explain the use of notions like *aggregate* physical capital, which, moreover, they would most of the time include in Cobb-Douglas type production functions, resting on decidedly shaky empirical support (as was pointed out in Section 7). These are applied as if they were part and parcel of everyday economic reality, not the slightest doubt being shown about them. Moreover, a further and even more problematic concept was brought in, namely that of a *physical quantity* of 'human capital', without any apparent need to consider the logical foundations or the conditions under which it could quantitatively be represented.

In his "Neoclassical theory of growth and distribution", Solow (2000) presents a valuable survey of these models and masterly illustrates their merits and limitations. There is therefore no need to indulge in repetitions here. What on the other hand may be worth dwelling on is the characteristics which the neoclassical origin of these models entail for the analysis of the problems of income distribution and the consequences following therefrom.

If we go back to the Harrod-Domar equation 11, we might say that, in the models with endogenous technical progress, the magnitude which is taken as unknown is g – the growth rate – as indeed it had been in the first-phase of the Kaldor model and in the Lewis model (see Section 5). But, whereas in Kaldor's (and Lewis's) models g is determined by the possibilities of capital accumulation, here g is determined by the possibilities of learning technological know-how. This marks an interesting, albeit not entirely new, contribution. As has been mentioned already, however, the authors of the growth models with endogenous technical progress have had greater ambitions. The other two magnitudes in the Harrod-Domar equation – v and s – are not taken as constant. They themselves are 'modelled' in such a way as to emerge from a process intended to represent maximising behaviour. In accordance with an approach that has found recent favour and diffusion, they are presented as having 'microfoundations'. It is from this feature that the growth models with endoge-

nous technical progress acquire their elegance and at the same time reveal their naivety. Basically, they reduce their aim at analysing the behaviour of a single individual considered as 'representative'; no longer a planner for all the other individuals but for herself. This extraordinary and queer individual lives forever, has perfect knowledge of the technical production functions, actually of the production function for one single good, and knows how to improve it (in other words how to produce technical know-how). She knows her utility function, from now to infinity; she adopts a (given) rate of intertemporal preference and knows perfectly how to allocate efforts and consumption over time, in such a way as to achieve maximisation of the present value of her satisfaction, again from now to infinity, given the characteristics of production, learning, and consumer preferences, from now to eternity. It is hard to think how such singular individual could possibly be attributed the characteristic of 'representativeness'. Whether she is 'representative' or not is precisely the question that one would wish to see demonstrated.[3]

In an aggregate model, these analytical expedients no doubt generate formal elegance. What is harder to grasp is their explanatory relevance. A reasonable attitude to adopt might well seem to be that of asserting, or claiming, that the individual being considered represents an average. But in this case there would be no getting away from the numerous inconsistencies of the expedient adopted, unless one takes the indeed widespread stratagem of eliminating all problems by adding a series of further simplifying assumptions; in this case by assuming that all the individuals are perfectly identical to one another, that they have exactly the same utility function, the same technical know-how – present and future – and the same skills in learning, forecasting, behaving rationally and so on.

One may wonder at this point whether too many problems have been assumed away simply *ex hypothesi*. There is not only the drawback of ignoring those problems – as Solow points out at the beginning of his contribution – that go under the rubric of "coordination", i.e. in practice the problems of employment and unemployment. In fact, the individual that is considered could not be partly employed and partly (involuntarily) unemployed. This would make

[3] See the severe critique of the notion of a "representative individual" made by Kirman (1992).

no sense in the context of the model itself. The singular individual that is considered could only be employed, and in effect permanently employed, in the best (i.e. optimal) possible way. But, there is an even more important problem from the point of view of this survey. It becomes pure nonsense to speak of income distribution. Among whom could income be distributed, if it always and entirely goes to the same 'representative' individual? Of course, it could go to the same individual in different forms; for example as wages and/or as profits. But to this distinction, if the 'representative' individual pockets all, it becomes difficult, or at any rate problematic, to find any significance. It is in fact the same individual who, by acting with maximising behaviour, will have her income emerging as profit or as wage according as to which is more appropriate for the maximisation of the utility and production functions. In other words, whether the income is received in one form or in the other becomes a consequence of the maximising process. Once again, the characteristics of the income distribution become purely secondary, which is a logical consequence of a basically neoclassical scheme, as should by now have become perfectly clear.

At the end of his survey mentioned at the beginning (see the close of Section 1 above), after pointing out that "Very little has been said in this survey about income distribution", Solow (2000, p. 378) goes on to give a justification: "That is because there is no special connection between the neoclassical model of growth and the determination of factor prices [i.e. income distribution]".

Those who have followed the foregoing arguments will surely understand the reasons of this singular pronouncement. But it is interesting to note that Solow adds (*ivi*):

> "The usual practice is to appeal to the same view of factor pricing that characterizes static neoclassical equilibrium theory. If the working assumption that all markets clear were to be lifted, an alternative theory of factor prices would certainly be needed. Much else would change besides".

Fortunately, a number of contributions have appeared in the most recent economic literature, that seem to be opening up new horizons precisely in this direction, and beyond.

11. Towards new horizons

The practical importance of the issue of income distribution is clearly too great for such an issue to be left on the fringe of economic research, despite the bias in this direction inherent in dominant neoclassical theory.

In this respect it is significant that in 1996, at the Annual Conference of the *Royal Economic Society*, the Presidential Address was devoted to the theme: "Bringing income distribution in from the cold". The President of the *Royal Economic Society*, Anthony Atkinson (1997, p. 297), opened his address with the words:

> "The title of this *Presidential Address* is chosen to highlight the way in which the subject of income distribution has in the past been marginalised".

Atkinson presented a review of the contributions that have begun to reappear in the economic literature during the last few years of the 20th century on the theme of income distribution. Although these contributions are not many in number, they have prompted him to conclude his survey with two positive remarks. The first is that "income distribution is beginning to receive again the attention which it merits" (Atkinson 1997, p. 318). The second is that "there is evidence that economics is beginning to learn in this area from other disciplines" (*ivi*). What is even more interesting, however, is something that the President of the Royal Economic Society did *not* say (or did not notice), namely that all the recent contributions, on which he puts so much hope, have been introduced from *outside* neoclassical economic theory, even when – as has happened for those contributions that, by being published in the major (mainstream) journals have attracted most attention – they have been inserted *into* neoclassical theory.

In short, one may list at least four new lines of research. There is in the first place the one that emerges from the words of Solow's survey quoted at the end of the previous section (Solow 2000, p. 378), namely that "[i]f the working assumption that all markets clear were to be lifted, an alternative theory of factor prices [and thus of income distribution] would certainly be needed". In fact, in the early enthusiasm over the neoclassical theory of economic growth, Stiglitz (1969)

had studied how – in a strictly neoclassical growth model (with all its typical assumptions: absence of intrinsic differences among individuals, absence of any imperfections in the capital market, absence of 'external shocks', etc.) – income distribution among individuals would in the long period tend to converge towards equality (and so would the distribution of wealth). He had, however, also proceeded to abandon some of the neoclassical assumptions, thereby finding that, in each of these case, the inequalities not only would reappear, but would actually tend very rapidly to increase. This second aspect of his article did not find further developments or followers. But it has now reappeared in the growth models with endogenous technical progress. A recent contribution by Galor and Zeira (1993) has opened up a whole spate of new research on this aspect. It has been realised that, even when one starts from an initial neoclassical set-up, the mere introduction of hypotheses of imperfections in the capital market, combined with the hypothesis of initial unequal distribution of wealth – for example, owing to inequalities in inherited resources – exert influence over the possibilities of single individuals to have access to various degrees of education (i.e. to what is improperly called the accumulation of 'human capital'). This can bring about considerable consequences for the economic variables, both in the short and in the long run, giving rise to diverging dynamic movements, that is to say, to widening inequalities in income and wealth.

A second line of research has been pursued – in a strictly neoclassical endogenous growth model – by Giuseppe Bertola (1993 and 1995), who has introduced a distinction between two categories of agents, although both are supposed to have the same utility function to be maximised under usual constraints on limitless horizons. The difference that has been introduced is to suppose that one category derive all their income from the ownership of capital goods, and the others from 'non-produced resources' (i.e., labour and land, between which no distinction is made by the author). The interesting finding is that the process of maximisation of the very same utility function leads the first category (let us call them the 'capitalists') to a positive propensity to save, and the second category (let us call them the 'workers' and 'landowners') to a zero propensity to save. Thus the Bertola model ends up by rationalising, in terms of microeconomic behaviour, what Ricardo (and Kaldor) had simply assumed, namely that only profits are saved – all savings are performed by the 'capital-

ists' – while wages (and rents) are entirely devoted to consumption. The other interesting result that implicitly re-emerges from this model is that once again it brings out – we might even say it re-discovers – the fundamental asymmetry between the factor of production 'capital' on the one hand and the factors of production 'labour' and 'land' on the other; an asymmetry that was at the basis of classical economics and had re-emerged from the *re-switching* controversy, but had since been forgotten or ignored in mainstream economic literature. It is thus not surprising that results very similar to those of Bertola had in fact emerged even earlier, anticipated by scholars pursuing Keynesian-Kaldorian lines of thought. For example, Mauro Baranzini (1991), in a work adopting a strict Kaldorian approach, but absorbing into the analysis elements of the life-cycle savings hypothesis in an overlapping generation context, began to introduce hypotheses on micro-behaviour at the level of single consumers, who are supposed to be concerned not only with their utility but also with the welfare of their children. Baranzini's results have seen the re-appearance of the 'Cambridge equation' – where workers' savings have no relevance (see Section 5 above), and where the rate of profits, and thus the distribution of income, are determined independently of the form of the production function.

A third line of research has come about with the introduction of a political channel into the endogenous growth models (see, among others, Perotti 1992, Bertola 1993, Alesina and Rodrik 1994, Persson and Tabellini 1994). This literature in fact tries an explanation – not of the distribution of income and of wealth (which, according to a strict neoclassical canon, is taken as given) but of a political decision, a decision of public choice concerning the re-distribution of existing wealth. The expedient is simple but ingenious. It begins by accepting the neoclassical approach of taking as given, at a certain point in time, the existing distribution of resources among the various economic agents, assumed to have all the same utility function and to act in conditions of perfect knowledge, perfectly free competition, and so forth. However a heterogeneity is considered among them (the only heterogeneity to be taken into consideration), deriving from an initial unequal distribution of wealth. By considering groups of agents subdivided according to classes of income, their interests will come into conflict over the public decision to set the level of income tax rates, since the tax will weigh heavier on the richer tax-payers, while it

seems reasonable to suppose that the public authority will redistribute the tax revenue in an egalitarian way, or will spend it on public services, in particular on education, which benefit all, again in egalitarian way. The idea has been to endogenise a procedure of public choice based on the median-voter theorem (Mueller 1989). This theorem guarantees that, under certain conditions, the rate that is chosen will turn out to be the one preferred by the voter that has an income equal to the median. From this result, one can draw conclusions on the relationships between the degree of income inequality and economic growth. On this basis, the authors – with some courage one may say – have carried out empirical tests by comparing data for various countries. As was only to be expected, the results have proved rather inconclusive. Nevertheless, the introduction of public choice considerations and theorems – extraneous to strict economic theory – has in general been greeted with satisfaction.

Finally, a fourth line of research has focused on personal income inequalities and, more particularly, on wage differentials among workers operating at various levels of responsibility, usually – but not always – corresponding to various degrees of education or of seniority, within the same industry and even within the same firm, let alone between different branches of industry.

The subject of income inequalities had been addressed in the past more by statisticians and demographers than by economists – though with some notable exceptions; let me recall Pareto's (1897) personal income distribution function, which however has nothing to do with his economic theories; but also, recently, Champernowne and Cowell (1998) – while the problems of wage differentials had in the main been left as a prerogative of labour economists. The fact remains that no generally accepted way had yet been proposed to accommodate the issue of personal income inequalities. In this field, both classical-Keynesian theories and neoclassical theory have traditionally dealt with the theme of income distribution in terms of income shares (rent, profits, wages) attributed to the categories of people who are behind the 'factors of production'. This approach had a justification at the dawn of the industrial revolution, when it seemed reasonable to associate the three factors of production with three distinct social classes, but it has no longer the same justification – or at least not to the same extent – in our economies today, when the very notion of 'social class' has grown in some sense vaguer and in some

other sense much more complex than it used to be in the past (see in this connection the work on social classes by Sylos Labini, 1974, and the ensuing discussions). The issue of wage differentials is even more complex. It has surprisingly received very little attention in economic theory in the past, in spite of its undeniable relationship with the problems of employment, involuntary unemployment and, more generally, with the operation of the 'labour market', if indeed this particular term can be used at all for labour.

But recently, precisely the particular characteristics taken up by technical progress, with its widely dispersed dissimilarities in causing the most diverse increases in productivity in the various branches of our economies, have stimulated a lively debate. On the one side the advocates of a competitive free market system claim that this applies to the labour market as well, with all the characteristics of flexibility which are supposed to bring every competitive market to full employment equilibrium. They attribute the wage differentials to what they call "skill biased" technical progress: wages increase for those people who are in demand, owing to their skills, better education and ability to operate computer-dominated technologies. On the other side there are those who see profound and peculiar characteristics in the 'labour market', structurally distinct from those of the markets for goods, precisely because it involves the subjects of economic activity themselves. From this viewpoint, it would appear inappropriate to apply to the 'labour market' the same concepts, and indeed the same rules, of the competitive markets, as if labour were a commodity like any other. Let me recall, for example, Lester Thurow (1975) who – in criticising the theory of marginal productivity – has drawn attention on the criterion of equity, as against that of efficiency; and also Adrian Wood's *Theory of Pay* (1978), based on the concept of "fair pay", as expressed by the actions of the Trade Unions, who however cannot remain entirely blind to the forces of supply and demand, when these come into conflict with the standard of "fair pay". Let me also mention the latest work by Tony Atkinson (1999), who has criticised the mainstream "transatlantic consensus" on the inevitability of rising inequalities, and has stressed instead the relevance of "social norms" and the effectiveness of public policies aimed at re-distributing personal incomes.

But perhaps the most original and provocative recent work on this subject is the one by James Galbraith (1998), who outright rejects

the "skilled-biased" technical progress hypothesis. He argues that the widening gap in American pay started *before* the diffusion of the computer technology and that the sharp increases in pay inequalities are caused: not by competition but by its opposite – the action of interlocking monopolies. Inventions – he claims – are created to increase monopoly power, while the innovating entrepreneurs co-involve their employees in this process. The technological improvements are thus presented as inequality increasing forces. He draws a number of implications for economic policy, which in turn lead him to stress the necessity of investigating how to shape appropriate institutions for a technologically advanced society.

It may be interesting to mention that Solow (1990) himself has recently come round to the idea of considering the 'labour market' as a "social institution". Here we are evidently moving into a field – that of institutions – lying beyond economic theory in the strict sense, but the inclusion of which into the analysis seems essential if we wish to understand and explain the most significant social phenomena characterising the present stage of development of the advanced industrial societies.

In this direction, the help that economic theory has been giving so far appears unsatisfactory, while the contribution that may be expected, in particular, from the neoclassical theory of income distribution seems decidedly scant.

12. A final critique

Perhaps the severest criticism that can be moved to neoclassical economic theory is that of having pushed the theory of income distribution into a secondary, marginal, role. This has happened owing to a combination of two of its typical features: the prominence accorded to the scheme of optimal allocation of resources in the Arrow-Debreu version and its neglect of the logical inconsistencies inherent in some of its analytical tools. These characteristics tend to persist, despite a number of strong innovative developments such as those associated with the investigation of endogenously motivated technical progress.

In such conditions, it is the real and concrete evidence of the day-to-day empirical importance of the problems connected with income distribution that seems to make some sort of resumption of the (earlier marginalised) theme of income distribution necessary. However, we must ask ourselves whether addressing the problems of distribution in this way is really of help, or on the contrary may be a hindrance to our search for some reasonable guidance in understanding the realities of the world in which we live.

There can be no longer any doubt that technical progress, receiving at last renewed attention, is a basic and indeed crucial aspect of today's industrial societies. Neoclassical economic theory had for too long neglected the subject, while classical economics had treated it in a non-systematic way and in any case had always underestimated its ultimate consequences. Dominant economic theory has at long last brought technical progress back into analysis in a strong way, but it is still concentrating only on a particular form of it – namely the endogenous form, which is not the only form of technical progress – and most of all it is still treating it in the aggregate form – an approach that definitely appears by now unjustifiable and even misleading. Above all, it has inserted it into a neoclassical theoretical apparatus, at the cost of pushing the problems of income distribution to the margin, thus compelling the theorists to find some way of bringing them back from outside, when they realise that they are becoming too important.

Is this the correct way ahead? An affirmative answer might even sound acceptable, to a certain extent, if it could be argued that technical progress reduces the importance of the problems of income distribution. But if we look around us, we get the impression that just the opposite is the case.

Among the economic characteristics that have most profoundly marked the last decades of the 20th century, income and wealth inequalities, in all their various aspects, emerge as one of the most important and disquieting phenomena. And it is precisely the particular way in which technical progress is taking place – with its typical features, generating new sectors and stimulating or producing new types of demand – that is constantly modifying, and pressing on, the inequalities.

The classical economists had somewhat simplistically thought in terms of three categories of income recipients, convinced as they were

that in doing so they could examine how the movements in production contribute to modifying the distribution of what is produced.

The picture has by now grown far more complex and in many respects it has radically changed. Inequalities occur not only among the three typical categories of income recipients, but also within these categories. At the same time, further categories emerge and are added. We must moreover take account of the distinction between those who perform a productive activity, or in other words have jobs (as employees or self-employed), and those who (against their will) remain excluded from employment. New characteristics are also emerging, which the diffusion itself – or the failure to get diffused – of technological know-how is conferring on the various economic systems that are competing with, or contrasting, one another.

Never in the history of mankind has the world shown such sharp inequalities in income and wealth as are to be seen at the end of the 20th century.

The final impression is that the most appropriate schemes for economic theory are precisely those that widen the scope for research into the problems of income (and wealth) distribution, not those that are pushing them to the margin.

It may perhaps be worth recalling, as noted in Section 5, that a whole alternative stream of research – and precisely that deriving from classical theory in its more modern versions, as conceived for example by Kalecki, Kaldor, Keynes, Sraffa and many others who have come after, and followed them – has been left aside over the past few decades. Yet the classical-Keynesian stream of thought appears by far as a more favourable frame of thought than the neoclassical one for the development of research into the whole institutional organisation of the economic systems, precisely because of its capability to absorb the diffused changes brought about by the structural dynamics imposed by the new technologies. Given the present unsatisfactory situation of the theory of income distribution, one should at least consider having second thoughts on what has been too quietly abandoned without any justification. It might well represent a fruitful reserve. Who, indeed, could reasonably rule out the possibility that a truly vigorous revival of this alternative current of economic research might open up far more interesting and promising opportunities and prospects than those that are at present being pursued?

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