political economy

Studies in the Surplus Approach

contents

On Changes in the Composition of Output*

Bertram Schefold

1. INTRODUCTION: PREFERENCES AND NEEDS

It has often been remarked that "demand" is missing from the Sraffa system. If the level and composition of output change, the input-output coefficients change so that there seems to be no room for a consideration of demand. If, on the other hand, distribution is given and there are constant returns to scale, prices are determined independently of the levels of output in the different sectors. It would then seem that demand conditions can be freely introduced, but they only fix the quantities. The latter case can clearly only serve as an introduction; yet it is regarded as the main case by neoclassical interpreters.

The difficulties surrounding such notions as "demand" and "composition of output" are connected with the specific classical methodology. It is a theory which, given technology, uses separate approaches to

a) the determination of output (effective demand regulating the level of activity and socioeconomic factors affecting its composition);

b) the analysis of distribution (the forces governing distribution are subject to historical change);

c) the theory of value (it shows how relative prices are determined if one of the distributive variables is fixed and if the structure of production and consumption is given).

The classical theory is made up of these constituent parts, and it varies considerably according to the assumptions made about, e.g., distribution. Neoclassical theory, on the other hand, is based on the unifying principle

of supply and demand which determines prices simultaneously with distribution and the composition of output. If the theory is to be subdivided, one mainly distinguishes partial and general equilibrium.

It is the purpose of this paper to show how the classical methodological distinction can be maintained in the face of changing conditions of demand. The solution is, broadly speaking, that (within certain ranges) the separation of the theory of value from the theory of output can be kept beyond the limits set by the so-called "non-substitution theorem" and that, where this is not possible, characteristic interactions between the determination of the level of output and the determination of prices take place which are in some cases quite different from those discussed in the neoclassical theory.

The differences arise mainly because neoclassical theory attempts to show the existence of an allocation, given technology, endowments and preferences, such that the plans of agents can be carried out in an equilibrium at full employment. It can ideally be restored in the face of an autonomous fall in the demand for some goods (due to a change of preferences) through an appropriate change of commodity prices and of the remuneration of factors, and this in turn causes the demand and supply of commodities and factors to be changed by the appropriate amounts. None of these mechanisms is accepted without qualification in the classical theory. In particular, supply and demand for factors are in general not expected to react to price changes so as to automatically restore equilibrium; classical (and Keynesian) theories regard full employment as special cases.

In order to make room for a classical treatment of demand, it is necessary first to review some of the neoclassical assumptions critically and to remind the reader of some logical objections against the neoclassical mode of reasoning. For it seems to be a fact that empirical and philosophical arguments have had a lesser impact on the academic tradition of identifying the core of economics with neoclassical theory than logical arguments, and unless the neoclassical way of thinking is effectively questioned, the classical propositions are not likely to be accepted.

After pursuing the traditional objections, i.e. the hypothetical character of preferences outside the equilibrium point (a), I therefore want to argue that "compromises" between neoclassical and classical approaches are problematic, if they are based on a neoclassical theory of distribution and a classical theory of prices (b). This will lead me to ask what we should mean by neoclassical theory: not a research programme but a closed and coherent account of how the economy is supposed to work (c). It will be shown that the logic of the neoclassical theory of equilibrium requires a high degree of substitutability (if not homogeneity) both of the "factors" capital (d) and goods (e), and the conditions which are necessary to

guarantee uniqueness of equilibrium are very stringent (*f*). The neoclassical theory of preferences necessarily provides an inadequate representation of the stratification of needs (*g*) and must conceal the conflicts between different social rôles played by individuals (*h*).

On the basis of this critique, a reconsideration of the classical theory will be proposed (*i*) which has historical precedents (*j*). It is very simple in its formal representation and does not give rise to the objections raised against the neoclassical theory. The main sections (sections 2-5) following upon this introduction will explain its use. After a reconsideration of the surplus approach (section 2) and a discussion of causes and effects to changes in the composition of output in single product systems with constant returns to scale (section 3), the crucial analytical step taken in the paper will be to extend this approach to joint production (section 4) and the case of variable returns (section 5).

a) Criticism of the assumption that utility functions or preferences are defined outside equilibrium is older than the developed forms of neoclassical theory themselves. One usually does not know — not even using introspection — what one's preferences would be, if one had to choose in an economic situation quite different from one's own. Even if preferences are fairly homogeneous within given income classes, one has first to learn the consumption pattern, the behaviour, in short the "life-style" of a higher stratum before one can move freely within it. Few people know how they should behave if their income were curtailed significantly. In particular, one knows very little about what one's preferences would be at different levels of employment and the associated states of the economy.

To this extent, the assumptions about consumer preferences lack plausibility, and so does the conclusion derived from the hypothesis, namely that an equilibrium wage obtains at a level of full employment such that the disutility of work is just compensated by its remuneration. In the course of the postwar race to catch up with the most advanced western nation, several states in Europe reached a level of full employment of the domestic labour force only twice: In the Federal Republic of Germany, for instance, there was a massive inflow of "foreign" workers at the beginning (the refugees). They were all absorbed into the labour force in the early phase of fast growth, but the moment of full employment could hardly be perceived since, in the next phase, foreign labour had to be brought in artificially in order to satisfy the booming demand, and, when growth slackened, the "overemployment" was reduced until the present state of underemployment was reached. A theory of full employment equilibrium is, under such circumstances, reminiscent of the famous clock which is accurate twice a day because it stands still.

Yet, such phases of accumulation are not entirely disconnected; there are learning processes going on in which firms move up a ladder of

technological evolution and individuals enjoy rising incomes and change their preferences or, better, their needs and life-styles, accordingly. The question of this paper concerns the treatment of states, and of changes, of needs and the corresponding adaptation of the composition of output in economies which follow specific macroeconomic paths.

b) This presupposes the adoption of the methodological principle of dividing the classical theory into one of output, distribution and value (and not, like the neoclassical, into that of partial and general equilibrium). Once the principle is accepted, one might be tempted to use the neoclassical theory of demand in order to provide a theory of the composition of output. But, on the one hand, such a theory is not missing in Smith, Ricardo or Marx[1]. On the other, the neoclassical theory of demand cannot be taken over because it is linked with the neoclassical theory of distribution. For, according to an argument stressed by Garegnani (1983), demand functions act on commodity prices through their influence on factor prices[2].

To see this, it suffices to consider the long period equilibrium of a system exhibiting (as is usual in neoclassical theory) constant returns to scale with an unlimited supply of each factor at constant factor prices. Prices are then equal to cost of production (the supply curve is horizontal) and demand determines the quantities to be produced. Only because factors are scarce, demand for them, as derived from the demand for commodities and augmented by the own demand by owners of the endowments, will cause higher factor prices to be associated with higher levels of output, and this will affect commodity prices, both directly through the cost of the factors employed as well as indirectly through the influence of the level of factor prices on the choice of technique.

The non-substitution theorem, by contrast, assumes given factor prices: "Capital" is equal to the value of produced means of production. In this sense it is not scarce, and the rate of interest (the "factor price") is given. If labour is the only non-produced factor in a single product system, prices will then be determined by and depend on the (nominal) wage rates; demand influences only the levels of output and hence of employment.

But prices will depend on demand, and the non-substitution theorem will cease to be valid, as soon as demand affects factor prices and, therefore, the choice of activities. For instance, the supply of labour may be related to the disutility of work and may be balanced against the utility

[1] See B. SCHEFOLD, "Nachfrage und Zufuhr in der Klassischen Ökonomie", in F. Neumark (ed.), *Studien zur Entwicklung der ökonomischen Theorie I*, Berlin, Duncker & Humblot, 1981, pp. 53-91.

[2] P. GAREGNANI, "The Classical Theory of Wages and the Role of Demand Schedules in the Determination of Relative Prices", *American Economic Review*, 73, 1983, pp. 309-313.

of consumption goods, while time preference determines the rate of interest (the "factor price" of "capital").

It might be concluded that preferences affect prices of goods through effects on factor prices in general equilibrium but that a dissociation of the neoclassical theory of distribution and of the neoclassical theory of the determination of demand through preferences remains logically possible. However, the usefulness of such an approach for a general theory may be doubted. Suppose e.g. that a Sraffa-type model with constant returns is given, that the wage rate rises with the productivity of labour, and that all technical progress takes the form of reductions in labour requirements. Rising incomes will cause shifts of the composition of output determined by Engel elasticities. It then follows that the share of wages and the level of employment will change — unless Engel elasticities are, as in Morishima[3], quite arbitrarily assumed to be equal to one — so that, even in this simple case, tensions may develop which put existing wage agreements into question. In a changing economic environment, they are likely to lead to changes of preferences. It will therefore be more appropriate to focus on the specific content of consumer demand directly; for it will be sufficiently difficult to predict consumer demand in a given state of prices, distribution and employment, even without formulating hypotheses about what consumer demand might be in a different state.

A faithful neoclassical like Schumpeter will consider preferences as fixed and as pertaining to one and the same long period equilibrium which remains fixed as employment fluctuates around the normal state[4]. But it is not plausible to extend the idea of given preferences to a theory of accumulation along classical lines, with a non-neoclassical theory of distribution and a neoclassical determination of the composition of output, if the economic environment changes, as the example of the two interludes of full employment in the Federal Republic of Germany illustrates.

_c)_ We are here thus not concerned with models which might allow an ad hoc combination of classical and neoclassical elements for the analysis of special situations. By neoclassical theory we mean the body of economic theory, derived from the marginalist revolution, which explains distribution and employment in terms of supply of, and demand for, factors of production in a general equilibrium which is meant to be used, in the analysis of concrete economic problems, by means of the familiar method of comparing equilibrium states. The equilibria therefore have to be stable and to be essentially unique.

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[3] Cf. M. MORISHIMA, _Equilibrium, Stability and Growth_, Oxford, Clarendon Press, 1964, p. 138.

[4] Cf. B. SCHEFOLD, _Schumpeter as a Walrasian Austrian and Keynes as a Classical Marshallian_, mimeo, 1983, 30 pp.

Many modern authors close to the neoclassical tradition are in reality trying to break away from it by introducing concepts of a different kind, such as that of effective demand, or by generalising particular models. Now it should be clear that a new model which generalizes the assumptions habitually required to prove a special theorem, e.g. the existence of equilibrium, at the expense of stability properties, may be of interest for the development of a future non-neoclassical theory but does not necessarily broaden the basis for neoclassical theory itself, if the latter requires, to be relevant and applicable, the stability and uniqueness of equilibria. Neoclassical theory, in this sense, is by definition one which must predict full employment, as a long period equilibrium around which oscillations in the form of business cycles may take place.

A firm belief in the working of the neoclassical equilibrium mechanism in this traditional, narrow but relevant sense is perhaps not often admitted today. Yet, this concept of neoclassical theory is appropriate for our discussion. In a similar vein, we shall interpret the analysis of preferences in the liberal tradition of individualism and are here not interested in formal extensions such as the consideration of externalities in consumption using interdependent utility functions.

It is then the purpose of the paper to defend the determination of the composition of output according to the classical tradition against the treatment of demand according to the neoclassical view. To do so, however, it would not be appropriate to confine the discussion to great authors in the neoclassical tradition (such as Marshall, Wicksell or Schumpeter). Modern Walrasian models (following Debreu[5]) and other works on demand by — if the expression is permitted — illuminated neoclassicals will also be used (sometimes, perhaps, against the intentions of their authors) to indicate limitations of the comprehensive neoclassical theory and to collect tools towards a reconstruction of the classical theory. Whether the same tools and models might provide a sufficient basis for some other new theory or a true generalization of neoclassical theories will not be discussed (I remain sceptical with regard to "neo-neoclassical syntheses").

The need to transcend the neoclassical framework now follows from an analysis of the economic logic of its own assumptions. Since this critique has been advanced on various occasions, a summary may suffice (points *d, e, f*):

d) The economic process can be subsumed under the concept of equilibrium only under restrictive conditions. If the equilibrium is intertemporal, competition will ensure that the rate of return (in terms of a given commodity) will be uniform for all activities used and equal to the

[5] G. DEBREU, *Theory of Value*, New York, Wiley, 1959.

own rate of interest of the numeraire commodity. The own rate of interest is, for this purpose, defined as the maximum rate of remuneration of a commodity, in terms of itself, to be obtained by investing or by holding it; hence it is equal to $(X_{t+1}/X_t) - 1$ if the quantity X_{t+1} of the commodity is the promised payback of the commodity in the next period and X_t the quantity available in period t, and $X_{t+1}/X_t = p_t/p_{t+1}$ where p_t, p_{t+1} are discounted prices of the intertemporal equilibrium such that $X_t p_t = X_{t+1} p_{t+1}$).

This leads to an inconsistency concerning the endowments which is easier to understand in a special case: If some reproducible endowments (capital goods i) are available in excess, their services will not be used and their own rates of interest $p_{o,i}/p_{1,i} - 1$ will be zero or low relative to their cost of reproduction which would be positive. They will thus partly be used, but (initially) not be reproduced which may violate the condition of the uniformity of the rate of profit with respect to traditional notions of long period equilibrium. Moreover, the corresponding stocks had once been acquired in order to use them profitably later and if they now yield no or very low returns, expectations are deceived, and these deceived expectations are not treated in the model[6].

The extent to which this will happen varies with the assumptions made. As Garegnani has shown in his discussion of Walras' model of capital formation, the difficulty disappears if capital is conceived of as a homogeneous magnitude[7]. Similarly, if all goods available as endowments are consumption goods as well as capital goods or if the time horizon is sufficiently long, and if there is free storage of goods, none of the endowments can be free in the modern intertemporal model because they will be shifted through time so that they will either directly or indirectly be consumed (assuming no satiation). But if capital goods are not objects of consumption (such as plant) and if they are subject to wear and tear, the being in excess of endowments represents — like that of excess capacities — an unpleasant surprise for their owners: they are not needed now and cannot be held without cost to be used tomorrow. Hence they are conceptually proof of a *dis*equilibrium. Even if their prices do not fall to zero but are low in comparison with their cost of reproduction, expectations are deceived and may, according to economic logic, lead to a fall of effective demand. From a normative point of view, it might be said that past mistakes should be irrelevant to the valuation of assets, but the experience of mistakes alters expectations in a dynamic process, and this is not taken into account in the modern neoclassical theory of intertemporal equilibrium.

[6] See my "Cambridge Price Theory. Special Model or General Theory of Value", *American Economic Review*, Papers and Proceedings, 75, 1985, pp. 140-145.

[7] P. GAREGNANI, *Il capitale nelle teorie della distribuzione*, Milano, Giuffrè, 1960.

Differences of rates of return in terms of different commodities are another aspect of the same phenomenon in models with a constant linear technology. If the initial stock of ovens, say, is larger than the amount of ovens which can be used to bake bread, given the initial stock of flour, the price of ovens will at first be low and rise over time as they are gradually used up until the level determined by the cost of reproduction is reached in a model with a distant time horizon.

To achieve one uniform rate of return which is the same in terms of any chosen numéraire, and to exclude zero prices of endowments of capital goods, a high degree of substitutability on the input side may thus be necessary in the neoclassical model, which, in the limit, entails that all means of production are of one kind.

e) We cannot discuss here the difficulties associated with a reallocation of misguided investment — ovens in our example — according to the neoclassical theory of supply and demand for factors of production. But it may be observed that one obtains a similar result regarding the substitutability of consumption goods, if the stability of equilibrium in tâtonnement processes is examined. The most meaningful sufficient condition (not capable of significant extensions according to Hahn)[8] guarantees that an equilibrium is stable provided that all commodities are gross substitutes[9]. But, at least according to classical thinking in the interpretation presented below (section 4), goods which are gross substitutes fulfil the same need and are, for the purposes of classical theory, conveniently treated as one and the same good (commodities should be defined according to their economic properties). Hence, in a sense, neoclassical theory is able to obtain a stable equilibrium by assuming that endowments and consumption goods are each reduced to one commodity. The problem of the neoclassical theory of capital and that of stability both disappear in a one commodity world.

To present the matter in this way implies a simplification. But the importance of the argument concerning stability is now much better understood because of Sonnenschein's and Debreu's proofs that to virtually every arbitrary system of excess demand functions an artificial exchange economy fulfilling the usual axioms can be constructed (with endowments and preferences for as many commodities as there are consumers) which approximates those excess demand functions to any given degree[10].

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[8] F. H. HAHN, "Stability", in K. J. Arrow and M. D. Intriligator (eds.), *Handbook of Mathematical Economics*, II, 1982, pp. 745-793.

[9] One extension is provided by MORISHIMA in his "A Generalization of the Gross Substitute System", *Review of Economic Studies*, 37, 1970, pp. 177-186.

[10] See H. SONNENSCHEIN, "Market Excess Demand Functions", *Econometrica*, 40, 1972, pp. 549-563; G. DEBREU, "Excess Demand Functions", *Journal of Mathematical Economics*, 1, 1974, pp. 15-21.

Therefore, if one wants to preserve one of the most fundamental neoclassical assumptions, i.e. that the free choice of individuals is given by independent preference orderings, one has to accept that unstable equilibria may result. Attempts to single out those systems of preferences (in terms of some property relating to needs and their satisfaction) which would exclude unstable excess demand functions have not been successful — and if they were, neoclassical theory would lose part of its claim to generality with respect to the possibilities of choice of individuals.

f) The application of equilibrium analysis is problematic unless the equilibrium is determined uniquely. For one can otherwise not say with certainty what the effect of a change in one of the parameters on the final equilibrium position will be. The long period positions considered by Sraffa are in this respect definitely superior to the neoclassical general equilibrium because they are always uniquely determined, except for some rather odd cases in the theory of joint production. In particular, given a vector of consumption goods to be produced, the criterion of profit maximization will lead to the choice of a unique technology in Sraffa systems [11]. But, as Kehoe has recently shown by using an index theorem [12], a (in general finite) number of equilibria may result in an economy with given preferences and endowments for each consumer in the neoclassical case. Kehoe has analysed the extension of known results from pure exchange economies to economies with production and found that even gross substitutability is *not* sufficient to ensure uniqueness in economies with production involving more than three consumers. The weak axiom of revealed preference ensures uniqueness, but to postulate it is to postulate that the economy behaves like a single consumer. Or it has to be assumed that the technology is given by an input-output system. Hence, it would seem that attempts to define those general equilibrium systems which are both stable and unique lead back time and again to one commodity worlds or to assumptions close to those of classical analysis. Perhaps this insight will help some of those educated in the neoclassical tradition to follow on the path traced below.

g) The high degree of substitutability required for the working of the neoclassical equilibrium mechanism contrasts with the complementarity of needs emphasized (implicitly) by classical authors and with the structure ascribed to needs in modern psychology. Gross substitutability in systems of excess demand functions also involves the supply of (or the own demand for) endowments. Ignoring this for simplicity, one may use a diagrammatic representation at the levels of the individual consumer.

[11] Cf. N. SALVADORI, "Existence of Cost Minimizing Systems within the Sraffa Framework", *Zeitschrift für Nationalökonomie*, 42, 1982, pp. 281-298.

[12] T. J. KEHOE, "Multiplicity of Equilibria and Comparative Statics", *The Quarterly Journal of Economics*, 1985, pp. 119-147.

Neoclassical theory assumes that between any two goods there is a definite relationship in that a price rise of the first leads to an increase (gross substitute) or a reduction in the consumption of the second (complementary good). The corresponding points in fig. 1 are P and Q_1, Q_2, Q_3 respectively where the reduction of good 2 is more (Q_2, Q_3) or less than the proportional reduction of good 1. An increase in the consumption of good 1, relative to the initial position A, is also possible (Q_3). Strict complementarity (proportional reduction in the consumption of both goods is accidental [point Z]). Note that only point P fulfills the condition of gross substitutability.
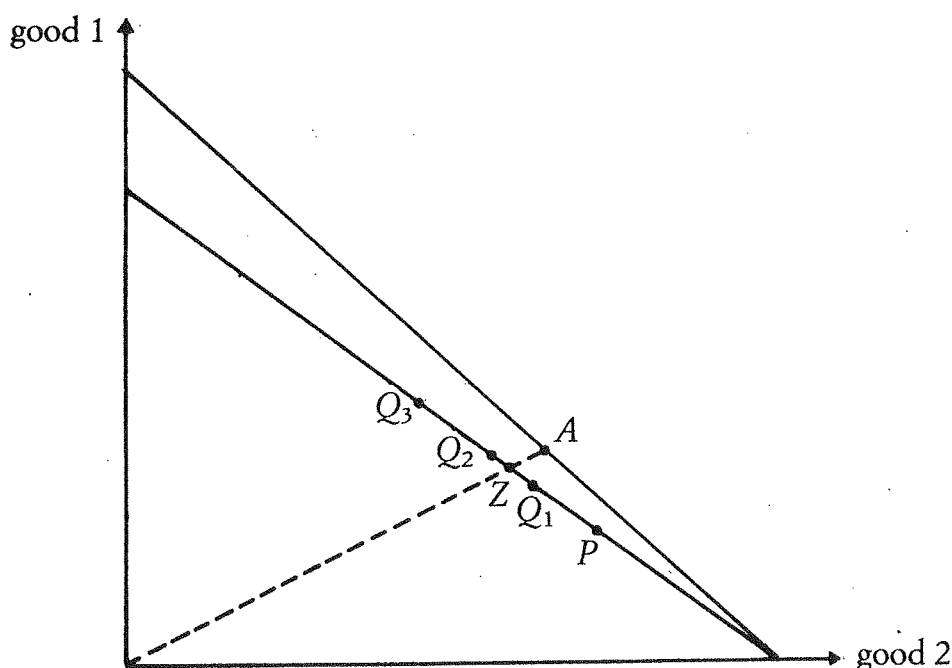

Fig. 1. Substitutability and complementarity.

But, as far as I can see, all theories of wants and their satisfaction (except the neoclassical) negate the generality of , substitution and postulate hierarchies of needs and their satisfaction. In the dialogue "Philebos", Plato's Socrates made fun of those who thought that "real" pleasure could be derived from the satisfaction of urges by giving in to any primitive impulse; he thought that the "Good" was acquired by higher intellectual pursuits which presupposed what we now should call a sublimation of some "lower" instincts. Much in the same way, the modern view is, that only the satisfaction of basic needs is tantamount to the reduction of an arousal in the nervous system. There is a want, associated with a desire to reduce it, in the case of "existence needs" such as the want for food, shelter and security, but there are also "relatedness needs" such as the want for love and recognition.

Already here we have a hierarchy. Not all needs of man are existence needs. There appears to be a second category of needs which may be different from the first even at the physiological level in that they are not satisfied by a reduction of the arousal of the nervous system, because they are motivated by the growth of the cognitive, aestethic and social abilities, the enlargement of the consciousness and the perfection of movements, actions and the minds of people. Such personal growth has, unlike the famous narrow capacities of the human stomach in Adam Smith, in principle no bounds[13].

The belief that these complex wants can be reduced to a system of preferences is mistaken because to the extent that there is a hierarchy of wants, a system of preferences allowing the construction of a utility function with the appropriate properties of substitutability does not exist[14]. For a hierarchy of wants implies a lexicographic ordering: First elementary needs have to be fulfilled before there comes the turn of higher needs; in the extreme, there is no substitutability whatever between them (though there may be a substitutability between goods fulfilling the same need). Given a minimum level of nutrition, music and bread are complementary (although they are hardly gross substitutes). Below, near the subsistence level, there is no substitutability at all.

b) The system of needs is further complicated because one and the same person may fulfil different rôles in society so that there is a faustian conflict about what one should do with one's time[15]: Should I dedicate it to my children as a father or to my students as a teacher?

To the extent to which there is no established hierarchy of my needs according to which I live, the conflict between rôles is inevitable. If I assume boldly that the set of potential objects for consumption is ordered according to a consistent set of preferences for each of a finite number of such rôles, any individual consumer consists, as it were, of several systems of preferences. It can then be shown that it may not be possible to aggregate those systems of preferences to one "higher" preference ordering for the individual much in the same way as it may not be possible to obtain a welfare function for a group of decision makers according to Arrow's impossibility theorem[16].

The customary answer to conflicting demands resulting from the

[13] See on this A. H. MASLOW, *Motivation and Personality*, New York, Harper (sec. ed.), 1970, and G. SCHERHORN, *Ökonomie und Ökologie*, mimeo, 1984, 26 pp.

[14] Cf. N. GEORGESCU-ROEGEN, *Analytical Economics: Issues and Problems*, Cambridge (Mass.), Harvard University Press, 1966.

[15] See U. KRAUSE and I. STEEDMAN, *Goethe's Faust, Arrow's Possibility Theorem and the Individual Decision Taker*, mimeo, 1984, 51 pp.

[16] K. J. ARROW, *Social Choice and Individual Values* (1951), New Haven, Yale University Press, second edition 1963/1970.

several rôles played by individuals in society is to cling to habits and conventions. This I regard as the justification for taking the needs of individuals in classical theory as given at the atomistic level. At the same time, the rôles one can play and the ways at one's disposal to satisfy one's needs are embedded in a given structure of production and consumption, and the satisfaction of needs — even the needs themselves — are conditioned by institutions at the macroscopic level. Different combinations of rôles are thus associated with different economic environments or life-styles.

However, the economic conditions under which the habits and the structure of consumption once were formed may change, e.g. because incomes rise and individuals assume new rôles; they then "learn" to behave according to a new pattern. Some of the changes so engendered may have to be treated simply as exogenous because they represent unique historical events. But others may have a more systematic character and find an explanation by dividing the mass of individuals and the rôles they play into social groups with economic characteristics, and by analysing the changing economic conditions of those groups.

i) Four hypotheses should be retained from these considerations which may be useful in the reconstruction of an alternative approach ("reconstruction" because they were present in the analysis of the classical economists):

1. There are hierarchies of needs from basic needs up to higher needs such as the need for self-fulfilment. The needs are taken as given in a given economic environment.

2. There are segments in the population which correspond to income classes (they have some sociological unity as well as economic properties in common but they need not be classes in the traditional sense of the difference between wage earners and capitalists). They are further to be differentiated according to environment, upbringing and cultural background. To different segments there correspond different patterns of consumption to satisfy the hierarchies of needs.

3. There are conflicts in the rôles one plays so that an individual may, as it were, belong to different segments at the same time.

4. There are learning processes associated with transitions between such segments.

I do not like the reduction of the individuality of persons to the fulfilment of these several rôles from a humanistic point of view but to some extent the reduction is objective through the opportunities which the economic system provides. To take the reduction as granted is then a useful step of theoretical abstraction. If one wants to take the individuality of persons into account in a subsequent step, the point is to understand how people react to changes in their environment, e.g. to the growth of material wealth.

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The task is now to show how these elements can be combined to introduce a theory of consumption in a classical framework. It is clear that the distinctions provided lead to important economic effects. For instance, the price elasticity of demand may be generally low for goods directly related to the fulfilment of basic needs. Income elasticities of demand may be explained in terms of migrations of people between income classes. Snob-effects (Veblen-effects, Giffen paradox) must be explained in terms of the sociological dynamic of attempted transitions to upper income classes and rôle conflicts may help to explain uncertain behaviour (do I save or dissave in a slump?).

The answering of such questions and the provision of theoretical underpinnings for well-established and useful concepts of applied economics such as elasticities are the testing ground for any theory of consumption. To do so, the four hypotheses are complemented by:

5. Households are units which produce the goods required to satisfy needs by means of commodities bought on the market and by means of domestic labour.

It is this last assumption which leads to the most definite conclusions regarding reactions to changes in prices and incomes. Elasticities will be higher if there are more processes to satisfy given needs.

j) My remarks about the historical background to this conception start with the last point. Similar extensions of the theory of production to the theory of the household have been attempted by neoclassical economists, and in a neoclassical framework, notably by Lancaster[17]. In Lancaster, the properties of consumption goods, not the goods themselves, are the variables of utility functions. Becker introduces activities as variables in his theory of a rational allocation of time[18].

A first difficulty with this is that households do traditionally not generally follow such rules of rationality so that one has, at least in principle, to distinguish between those activities of the household which are subject to a rational plan and others; the approach proposed above applies to that limited domain where it is meaningful to say that the costs of fulfilling given needs by means of goods and services in domestic production are calculated and minimized.

But the main drawback to using preferences is the consequent loss of operationality. The determination even of a partial neoclassical equilibrium requires full demand and supply curves, not only elasticities as expressions of the direction of expected deviations from a given equilibrium.

[17] K. J. LANCASTER, "A New Approach to Consumer Theory", *Journal of Political Economy*, 74, 1966, pp. 132-157.

[18] G. BECKER, *Der ökonomische Ansatz zur Erklärung des menschlichen Verhaltens*, Tübingen, 1982.

Within the neoclassical universe of thought, this difficulty will not be overcome because it is the point of the neoclassical approach to regard the individual as given, the sovereign in the world of consumption. This is a respectable point of view if contrasted to authoritarian attempts to impose an exogenous will — albeit that of a majority — on the freedom of choice of individuals. But the question of the freedom of choice is neither here nor there in our discussion. For, as explained above, we doubt the legitimacy of postulating consistent preferences even from the logical point of view. The programme of methodological individualism may be proposed, but it may also be asked whether its assumptions are reasonable. And if individualism is the dominant point of view, we may perhaps be allowed to stress here the opposite approach, without trying to provide a final answer to the age-old problem of the reconciliation of freedom and necessity.

At any rate, the classical question was, in modern words, how a sociological theory of the development of households within a given culture could be linked with a theory of the economic mechanism. Here we have the relevant formal concepts for such an approach. Where the satisfaction of needs does not require processes of domestic production, or where we believe that action is not rational, we identify the needs with consumption goods and take them for our present purposes as given. But the sphere of domestic production is an important historical variable and it seems, after having shrunk for a long time, again to be growing[19]. Where the rationality of capitalistic production really penetrates the household, a corresponding analysis in terms of cost minimization is appropriate; the primary example of such a change, which has recently taken place, is that of the saving of energy in domestic heating.

The historical background to this approach is provided by the traditional distinction between necessary and luxury goods. The former were thought to correspond to given needs, as determined by the necessities of daily life in a certain environment shaped by traditions, historically achieved standards and other influences on the conditions of reproduction in a social stratum. The necessaries were there to fulfil, in modern terms, existence needs, while luxuries essentially served the fulfilment of "higher" needs (relatedness needs). The luxuries could be fanciful gadgets but also the attributes of a superior culture displayed by members of the upper classes. Whether frivolous or artful: the distinction referred to an economic difference which had macroeconomic consequences. The provision of necessaries provided a lower limit to the real wage while the consumption of luxuries was by definition more volatile. Increases in luxury consumption were defended on the grounds of a

[19] Cf. J. GERSHUNY, *Die Ökonomie der nachindustriellen Gesellschaft. Produktion und Verbrauch von Dienstleistunge*, Frankfurt, Campus, 1981.

theory of effective demand (Malthus) or regarded as a diminution of saving and of investment (Ricardo). In either case there were connections with the theories of growth, distribution and employment (and also, to some extent, with the distinction of productive and unproductive labour). The task of a modern non-neoclassical theory is to take up these conceptions, using the results of modern psychology, and to integrate them as stylized facts in a theory of value, distribution and output.

This would imply also to take up older, normative views of what is now called welfare economics. Adam Smith argued in his "Theory of Moral Sentiments" that a cultural advance of society will be possible on the basis of economic progress because people wish to excel and to arouse the sympathies of others and, in so doing, display works of art even if they are themselves not talented. For Smith, riches were, in a Hobbesian tradition, power, not utility. The diamond was expensive because it was difficult to get; it was useful not as an object of individual utility but because it could be used to impress others by showing one's potential to command labour. For a neoclassical, this would only be an odd external effect; for Smith it was part of the core of his theory.

Smith's critical outlook caused him to view the worker as a person reduced to the consumption of the necessaries of daily life and unable to develop broader faculties, i.e. to satisfy higher needs. It was logical that the vanity of the upper classes was connected with the deprivation of the lower. However, extremes were controlled by the "internal spectator". The wish to excel (a relatedness need) was ineffective unless one was able to conform to higher moral and aesthetic standards embedded in each individual. Smith's economics therefore was part of a larger social theory which we may not share. But it is clear that a return to the classical theory of needs also implies an attempt to transcend the Paretian ideal.

Today, there are many interesting departures or generalizations from neoclassical theory. Learning processes have been modelled in terms of adaptive preferences[20]. Parrinello[21] has proposed a theory of deferred decision taking: a decision not to consume now does not necessarily mean to save indefinetely, nor to have a plan for a specific act of consumption in the future; it can also mean to keep the option for the consumption of luxury goods later open, without specifying now the specific content. But several different models to formulate aspects of classical theories of consumer demand have also been proposed. Pasinetti has used Engel-curves to represent learning processes in his theory of growth and

[20] See C. C. V. WEIZSÄCKER, *Adaptive Preferences*, mimeo, 1983, 35 pp.

[21] S. PARRINELLO, "Flexibility of Choice and the Theory of Consumption", *Metroeconomica*, 34, 1982, pp. 1-10.

structural change[22]. The tool can be reinterpreted to describe a migration from lower to higher income classes as suggested above.

The changes in social values which accompany a process of accumulation cannot, however, be completely subsumed under a concept of Engel-curves, if those who will be rich tomorrow decide — because their cultural outlook has changed — to follow a consumption pattern which is different from that of people who own the same riches already today. If, for instance, it should be true that concerns for environmental problems increase with the advances of a modern industrial society, the income elasticities for certain positional goods such as motorcars will diminish and those for health food will increase, and this change of preferences can be represented by letting the demand curves shift accordingly, with election results serving as indicators for the change of social values[23].

But, by considering the household as a producing unit which uses the commodities bought on the market for consumption to produce goods to fulfil needs, we shall follow a much simpler approach here. Different needs will be regarded as complementary, and where there is substitutability between goods, it will be regarded as due to the possibility of using different goods to fulfil the same need. While neoclassical economists have sometimes attempted to reduce the criterion of profit maximization to that of the maximization of utility, we thus go here in the opposite direction[24]. To the extent that households are tradition-oriented, they are assumed to buy commodities for consumption in fixed proportions which they "need". To the extent that the principle of opportunity costs has penetrated their private lives, members of households are assumed to behave rationally and to produce the satisfaction of their given needs by choosing the cheapest method of transforming commodities for consumption into the objects they desire. As a result, they will, even with given needs, be responsive to changes in relative prices.

The main difficulty concerns the treatment of income effects. Significant income effects can only be analysed by relaxing the budget constraint and/or by showing how changes in savings and/or distribution accomodate the income effect of a price change with macroeconomic consequences. After presenting the surplus approach (section 2), we shall first analyse such interactions by means of single product systems with constant returns (section 3) and then show how the analysis can be extended to joint production and variable returns in subsequent sections.

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[22] See his *Structural Change and Economic Growth. A Theoretical Essay on the Dynamics of the Wealth of Nations*, Cambridge, Cambridge University Press, 1981.

[23] We have tried to show this point in a project relating to energy (see R. A. DICKLER, Exogene Vorgaben des Szenarios "Wertwandel", *Anlagenband I zum Bericht der Arbeitsgruppe "Modelle"*, Enquête-Kommission "Zukünftige Kernenergiepolitik", Deutscher Bundestag, 9. Wahlperiode, 1983, pp. 106-135).

[24] See A. LOWE, *On Economic Knowledge* (1965), repr. New York, Harper & Row, 1983.

2. THE SURPLUS-APPROACH

Sraffa's starting point is to consider systems capable of selfreplacement[25]. The economy is observed in a given period, producing commodities by means of commodities with a surplus, and in a given state of distribution. The wage rate is uniform, after having normalised different kinds of labour by taking the wage rates paid to different kinds of labour as weights. An explanation of relative wage rates in terms of skills and other causes for a segmentation of work would have to take various factors into account, such as the costs of training, the importance of incentives for different kinds of work, traditional hierarchies and the scarcity of particular skills. Skills may lead to rents which have to the explained in terms of a multiplicity of methods of production (section 4).

The rate of profit is assumed to be uniform in order to calculate prices of production as conceptual magnitudes. These prices of production do not have to appear as the prices paid in the actual economic system; they provide reference points against which the importance of deviations of market prices, due to imperfect competition on the one hand and temporary disturbances on the other, can be measured. If commodities are durable and stocks can be carried at negligible costs, if competitive forces are strong and the necessary funds for accumulation can be provided through capital markets so that investment need not be primarily financed internally, and if firms set prices, mark-ups are likely to reflect the uniform rate of profit directly and temporary disturbances are smoothed through adaptations of stocks. But if there is imperfect competition, there will be an associated hierarchy of rates of profit. Market prices and prices of production will also differ, if there is fluctuation not mitigated by stocks, e.g. because of an annual harvest of perishable goods. Finally, profit rates differ, if there are imperfections in the capital market so that the funds for investment in sectors expanding at different rates of growth have to be generated internally. In principle, however, a uniform rate of profit is possible even with some sectors shrinking and others expanding and with all savings flowing from profits, if the profits of slowly growing or slowly shrinking industries are channeled to those which accumulate more rapidly. Fast growing firms then pay interest to those providing finance.

Although the uniform rate of profit will in most cases not be a close approximation to the real situation, it represents a convenient starting point for conceptual, and in many cases also applied, investigations. For it is obvious that large deviations of actual prices from prices of production

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[25] P. SRAFFA, *Production of Commodities by Means of Commodities*, Cambridge, Cambridge University Press, 1960.

imply corresponding large deviations between rates of profit so that the competitive forces will eventually lead to a correction (possibly involving new institutions). And even if cumulative forces for a deviation from the equilibrium persist for a long time (like, for instance, the profits of an urban center which exhibits consistently higher profits than are obtained in the surrounding countryside), the individual characteristics of the situation will still have to be explained with reference to some level of "normal" or "average" profitability.

To consider the system in its self-replacing state and to calculate the associated prices of production is therefore only a first step in an analysis which aims at an understanding of change over time. The analysis of accumulation and structural change can proceed by means of two different methods (which can in turn each be differentiated in various ways): The comparison of different states and the consideration of a slow and gradual transformation over an extended period. An example of the first is provided if we compare an economy such as it is at a given moment with what it would have to be, if different conditions of production are imposed from outside. According to this approach, decisions about the method of production to be regarded as "socially necessary" have to be taken in the light of estimates about the potential growth of productivity and its compatibility with other data such as distribution and social values. Ricardo thus treated as socially necessary that technology which allowed to satisfy *total* demand in the long run in the cheapest way, i.e. the technique employed on the marginal land in agriculture and the most productive technique in manufacturing industry.

Alternatively, the second method of considering gradual transformations is employed, if a mixture of existing methods in each sector of the economy has been interpreted as the socially necessary technique. This was the approach suggested when classical authors spoke of "averages" but the same principle underlies the construction of input-output tables. The slow transformation results, if the activity shifts within each sector from older to more advanced methods of production.

The theoretical solution to the problem of the choice of technique is provided by the criterion of profit maximization. But, since we do not attempt a simultaneous determination of a full employment equilibrium as in neoclassical theory, there is here more room to take institutional forces influencing technological change into account. The traditional example is provided by the Marxian theory of the falling rate of profit. As I have shown elsewhere[26], it was based, in the *mature* Marx, not on an aprioristic reasoning according to which the production of relative surplus value

[26] See my "Different Forms of Technical Progress", *The Economic Journal*, 86, 1976, pp. 806-819.

would always have to entail a rise in the organic composition of capital, but on an analysis of different forms of technical progress (in particular mechanization) which lead, under his stated assumptions, in fact to a diminution of the maximum rate of profit of the system. For — according to his definition — mechanization saves labour but not raw materials in the industry which is being mechanized so that the use of raw materials overall increases because some are needed in the construction of the machine. Such an analysis requires the consideration of technological change at the level of the physical requirements of production and their evaluation in terms of prices of production. The same methodological principle is nowadays being used (with, of course, different results) when the economic impact of the microelectronic revolution on different economies is assessed using projected changes of the input-output structure. Changes in the composition of output are associated with most forms of technical change, but insofar as these changes are consequences of technical progress, we shall not treat them further here. To the extent that the theory of the composition of output is concerned with the content of investment, it transcends the scope of the present paper.

The influences on distribution must usually be considered as a separate force in the analysis of accumulation. Since they intersect with the influences on the composition of output of consumer goods in different ways, it is necessary to refer to them briefly. Different theories of distribution can be of nearly equal importance either because they refer to different historical periods and circumstances or because they refer to influences acting at the same time, with one set of influences setting bounds within which another set of influences operates.

To start from a given real wage and to regard profits as a residual was the first approach taken at a time when real wages had shown a remarkable stability over centuries in spite of short term fluctuations. If the subsistence wage is interpreted in historical terms, its magnitude is to some extent a result of power relationships. Such power relationships can also be balanced if the share of wages is kept constant or if a degree of monopoly prevails. In either case the rate of profit has to be derived. During the period of rapid accumulation after the second world war a theory has been stressed according to which effective demand can entail a redistribution between classes, given the savings propensities of capitalists and workers, such that the rate of investment determines the rate of profits. According to this view, a higher ratio of investment to output can be financed because savings rise with a rising share of profits so that prices can be kept above costs in spite of the forces of competition: firms are able to finance their expansion out of profits, which are high because demand — largely generated by the firms themselves — is booming. With a given capital-output ratio, the rate of growth of capital determines the rate of profit. The theory is valid in a state of high confidence such that firms

prefer to expand normal capacity to using capacity to the limit, and it presupposes that real investment can be financed at low rates of interest. Sraffa has suggested, by contrast, that the rate of profit is determined from outside the system of physical reproduction by the level of the monetary rates of interest. This theory, though perhaps of broader application, is plausible especially in a state of slow growth, if expansion is financed primarily through banks which charge a rate of interest and if competition tends to reduce profits to them, while the gains derived from entrepreneurship take the form of managerial salaries. It is then interest as a cost which determines the rate of profit so that the banking system can increase the latter by raising the former. In this case a temporary spurt of demand leads to a fuller capacity utilization rather than to a higher growth rate. Various such models are conceivable and I see no reason to privilege one of them on grounds of apriori arguments. But it must, of course, be possible to formulate each model consistently and in such a way that it is compatible with the chosen theory of value.

To the extent that the theory of the composition of output is a theory of consumption, it has to be approached in the same spirit (we deal with the theory of the composition of investment only indirectly in this paper). We shall try to formulate the most simple conceivable model and show how it can be compatible with the theory of prices.

3. SINGLE PRODUCT SYSTEMS AND CONSTANT RETURNS

The case of single product systems with constant returns and with a given distribution seems to present no problems; quantities are given in terms of social needs and expand with accumulation. Prices are given independently of the levels of output so that various explanations of demand are compatible with a given structure of production and distribution. Morishima has shown how preferences may be introduced without affecting a Cambridge-type theory of income distribution with given savings propensities on a balanced growth path[27]. His assumption of Engel elasticities equal to one precluded an influence of demand on factor prices and hence the operation of the neoclassical interrelation between demand and distribution. To represent demand by means of given needs in a given period is, from a formal point of view, then even more trivial.

But how are income effects associated with growth to be treated? If incomes change because of a change of the distributive variables such as a rise of the real wage rate associated with a change of productivity, wage

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[27] Cf. M. MORISHIMA, op. cit., p. 138.

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earners get the opportunity to buy commodities which were not part of their habitual consumption basket. If they exercise their option, they acquire what at least initially must be considered as luxury goods; if they do not, they save. This shows that in this view the budget constraint must be assumed to be weak in that there is no necessity to spend incomes fully, and that there is a symmetric possibility of spending (slightly) more than current income. In the absence of perfect foresight there can be no definite commitment to the purchase of specific future consumption goods. On the other hand, there may be a pattern to the way in which people climb a social ladder as they receive higher incomes. Their behaviour can then be predicted on the basis of an ordering of consumers according to income classes. This yields an explanation of income elasticities of demand.

It is natural to order these three possibilities and to assume a social process by which rises of incomes are first saved, then spent for luxury goods, and these luxuries tend after some time in turn to be regarded as conveniences in a habitual standard of life.

Next we come to exogenous price changes. Among the possible causes we may mention that the cost of production may rise in particular industries according to the theory of differential rent and that there may be reductions of prices with technical progress. After the change, there may again be constant returns within a certain range, as we shall see. The income effect of price changes on the standard of life of households is often negligible because of the weak budget constraint. The operation of a weak budget constraint can be understood by analogy with the constraint under which firms maximise their profits in classical theory. For it can be assumed only in the neoclassical theory that there is a perfect capital market which allows any firm to hire factors of production, given factor prices, without regard to a wealth or capital constraint of the firm, up to the point at which the value of the marginal product equals the factor price, leaving the size of the firm indeterminate in case of constant returns. In classical theory, it is assumed (often only implicitly) that firms are restricted by the amount of capital they own — otherwise, workers could become capitalists. The existence of credit weakens this constraint but does not eliminate it; the amount of credit which an individual firm can obtain depends on many factors, but it is, as a first approximation, proportional to the wealth already owned. Credit allows firms (up to a point) to pursue given investment strategies in the face of indivisibilities. Much in the same sense consumers can — within limits —, adapt their methods of domestic production for the fulfillment of a given need in the face of changing relative prices. This is again the effect of the weak budget constraint. There results a small effect on the level of savings.

The macroeconomic effects become important, if there is a series of such changes. We take the case of a fall in the relative price first. With

rapid technical progress in many sectors, which proceeds sufficiently evenly so as not to disturb steady accumulation, the savings so obtained may help to finance the process of investment. The increase in the disposable income of households also allows them to acquire more or new luxury goods. Effective demand is then increased, and the budget constraint is observed in that additional income is spent.

If, on the other hand, some price rises relatively to the others to a significant extent because diminishing returns are operating within the system, the surplus tends to get reduced and there results a threat to the existing state of distribution. Ricardo had such a case in mind when he spoke of a reduction in the general rate of profits and a redistribution in favour of the landlords. He assumed that the money wage of workers rises with the price of corn so as to keep the real wage constant. Ricardo's assumption eliminated the problem of effective demand but, a priori, price rises may work either way: if households try to maintain their level of consumption, effective demand is increased since costs have risen, but if purchasers are discouraged and renounce the satisfaction of their needs, effective demand falls.

Generally, households will try to limit the impact of a fall in the real wage by substituting other methods of domestic production. If, for instance, the price of oil rises, they will start to wear sweaters, later to use gas, and to insulate houses, so as to maintain, as well as they can, a certain level of comfort. In doing so, households rarely revert to previous forms of behaviour; the fall of the price of oil in the fifties and sixties and the later rise did not lead back to the consumption patterns of the fifties. It is therefore not illuminating to represent such a process of substitution as a substitution according to given preferences; it is more pertinent to analyse technical progress in the methods of domestic production which depend on the availability of consumption goods. Changes in methods of production are easier to observe while needs remain relatively stable, and if they are transformed, their change should be traced back to definite causes.

Processes of substitution of the same type take place with all kinds of domestic activities: if grapes are expensive, one substitutes apples in order to have fruit. The formal treatment can be very simple. If (a_i, l_i) denotes a vector of consumption goods a_i and the input of domestic labour l_i necessary to fulfil a given need in a household, and if there are n such domestic processes of production possible with $i = 1, ..., n$, the household maximizes its "profits" by minimizing its costs, given the costs of the consumption goods and a value attributed to the domestic labour. The wage rate used to measure domestic labour is, under conditions of perfect rationality, equal to the wage rate obtainable by the working members of the household, and a rate of profit on costs can in principle also be charged. It has already been stressed that this form of rationality

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penetrates the household only slowly; other forms of rationality exist not only by virtue of the forms of tradition but are also recreated by obvious other social forces which need not be discussed here.

If one wishes, therefore, one may list the inputs in terms of consumption goods to be bought on the market (and this includes, e.g., material for the insulation of houses) with the associated inputs of domestic labour. To each set of prices and a wage rate there corresponds a demand for inputs to the domestic processes of providing heat (or saving energy) of any given household under ideal conditions (absence of habits and ignorance, instantaneous adaptation etc.). This is a demand associated with prices. One can then work out how demand changes with changes in prices, taking complications such as the diversity of households, speeds of adaptation etc., into account and thus arrive at short run and long run demand schedules.

The analysis of the methods of domestic production is subsequent to the analysis of the methods of industrial production. Or, if one prefers, some methods resembling those of an ordinary Sraffa system are reinterpreted as groups of methods of domestic production and added to it. Each group represents domestic production according to the life style associated with a segment of the population and the income which finances the purchase of the inputs necessary to those processes. Sraffa has excluded them from the core of his theory since his definition of the wage as a share in the surplus leads to the interpretation of consumption goods as non-basics which cannot enter his standard system.

Changes of domestic methods of production and elasticities are thus analysed, given distribution and the basic system. Large deviations from the existing state of affairs are not compatible with the general approach presented here so that the schedules obtained are not really full demand curves but indications of what the elasticity of demand might be in the neighbourhood of existing situations; the short run elasticity indicates what the reaction would be to changes in market prices while a long run elasticity is an expression of how the demand of households might shift in a process of accumulation involving changes in relative prices. Movements of demand are reversible if the needs and the means for their satisfaction are constant. An exact formulation is not necessary here and perhaps not appropriate because it might conceal the importance of the other factors mentioned above, i.e. the weakness of the budget constraint and the importance of cultural factors in the explanation or, rather, phenomenological description of the evolution of consumption of luxury goods.

We can thus see how the methodological separation of the theories of output, of value and of distribution can be maintained to some extent with single product systems because, with constant returns, prices are determined and remain the same with small changes of the output composition while larger changes, especially if they affect the budget constraint

significantly, lead to a consideration of the interaction of the theories of output, distribution, and effective demand so that the quantity system and the distributive variables, which together determine prices, undergo a transformation. Under the conditions stated, the methodological separation of the theories and a sequential consideration of change are therefore not incompatible.

The crucial question is, whether this methodology can be pursued also in those cases which have by neoclassicals traditionally been considered as their special domain: joint production and variable returns to scale. For the neoclassicals have (starting with Jevon's critique of Mill), habitually thought that under those circumstances the classical theory of value must fail and concluded (but it is a *non-sequitur*) that "value depends on utility". They thought that relative prices of joint products could not be ascertained through a cost of production approach (as such they saw the classical theory) without taking into account what John Stuart Mill called "the antecedent forces of supply and demand"[28]. But we shall now show — and this is, analytically speaking, the testing ground for the idea of this paper — that Sraffa has found a way to extend the classical methodoloy. It has been explored elsewhere[29]; here, I shall present a summary which stresses the link with classical views of consumption. The key idea is to analyse change sequentially: if, e.g., technological change is to be considered, the vector of final demand (which includes domestically produced consumption goods) is regarded as given[30], while methods of production are regarded as fixed, if we want to analyse (small) changes in demand. Large changes in demand may necessitate technological changes (in the case of joint production), and this may be a more complicated matter especially if there result effects on distribution.

4. JOINT PRODUCTION

As is well known, Sraffa assumes that the number of commodities produced is equal to the number of processes used, i.e. that his system is "square". This equality seems problematical to the ordinary economist for at least three reasons:

1. Casual observation suggests that multiproduct industries are frequent and single product industries are rare. Against this, Sraffa's

[28] J. S. MILL, *Principles of Political Economy with some of their Applications to Social Philosophy* (1848), reprint Toronto, University of Toronto Press, 1965.

[29] See B. SCHEFOLD, "Von Neumann and Sraffa. Mathematical Equivalence and Conceptual Difference", *The Economic Journal*, 90, 1980, pp. 140-156; "Sraffa and Applied Economics: Joint Production", *Political Economy - Studies in the Surplus Approach*, 1, 1985, pp. 17-40.

[30] Cf. my "On Counting Equations", *Zeitschrift für Nationalökonomie*, 38, 1978, pp. 253-285.

suggestion is that multiple product processes coexist in sufficient number so that the equality between the number of commodities (goods with positive prices) and processes used can be established. But in many cases there seem to be too few processes and an abundance of commodities (for instance products of oil refineries) while on the other hand there is often a multiplicity of methods for the production of the same commodity. For instance, there are several competing methods of producing steel.

2. Sraffa's procedure is not immediately reflected in the literature on business administration. On the contrary, in those markets where prices can be set by producers, procedures for ascribing costs to individual products in order to charge a mark-up are difficult because of the presence of joint costs, i.e. because of joint production. Conversely, in those markets where prices should be regarded as given, it is difficult to ascribe the profit contributions to individual products as long as the problem of joint costs has not been solved. Accounting is for this reason nowadays often seen as a strategic tool of management rather than as a rational procedure for measurement according to impersonal standards.

3. In modern theory, overproduced goods are free and unprofitable activities not used. It can be shown that neoclassical versions, using preferences or utility functions, do not necessarily yield "square" solutions, i.e. solutions where the number of commodities (goods with positive prices) equals the number of activities used.

The reasoning of the marginalists can be illustrated by means of the following simple diagram. Assuming a linear technology with constant returns to scale (therefore "rigid" joint production for any given method), the transformation curve is spanned by a (finite) number of activities for the production of two goods. The equilibrium will be found at the point where an indifference curve touches the transformation curve. If this happens at a corner of the transformation curve, two commodities will have been produced by one method and relative prices will be determined by the rate of substitution as in *fig. 2a*.

But if the equilibrium lies on a linear segment spanned by two activities, we can, from a neoclassical point of view, conclude that the relative price is also equal to the rate of transformation (*fig. 2b*). It is easily seen that this will be equal to the corresponding price ratio obtained in a Sraffa system of the form:

$$(1 + r) Ap + wl = Bp$$

with A, B being square matrices. Under suitable assumptions[31], the price

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[31] See *ibid.* and my *Piero Sraffas Theorie der Kuppelproduktion, des Kapitals und der Rente* (Dissertation, English Title: "Mr. Sraffa on Joint Production"), Basel, 1971 (privately printed, second edition in preparation).
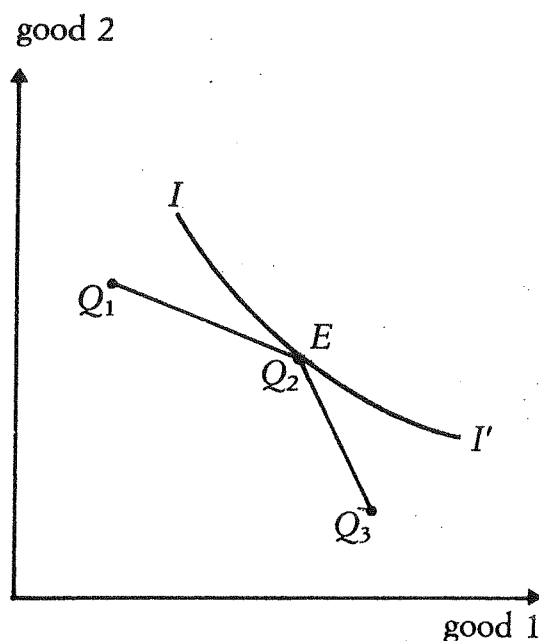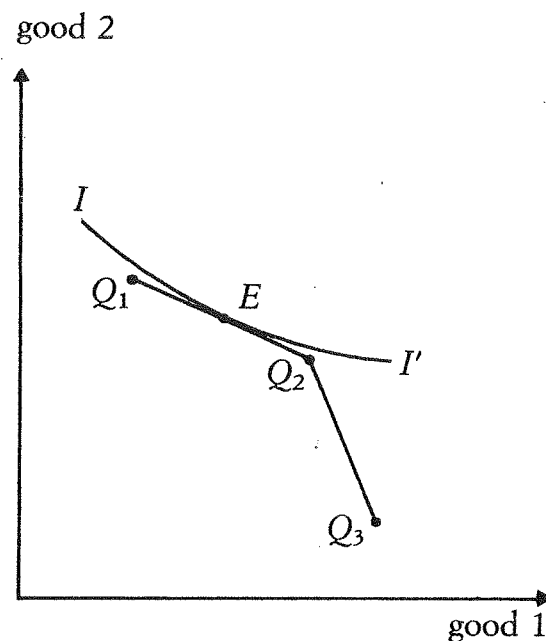
good 2   - good 2

I   *I*

Q_1 Q_1 *E*

              E
Q_2 Q_2 *I'*

                        I'

Q_3 Q_3

good 1   good 1

Fig. 2a   *Fig. 2b*

Fig. 2. Transformation curve spanned by three processes Q_1, Q_2, Q_3; equilibrium E determined by indifference curve II'. The two commodities may be produced by one (Q_2 in *fig.* 2*a*) or by a linear combination of two processes (Q_1, Q_2 in *fig.* 2*b*).

vector of such a Sraffa system will be determined and positive for a given rate of profit, and the price of any two commodities can be represented in a diagram analogous to diagram 2*a*, *b*. Let b_{ij} be the output of commodity *j* in process *i*. Without loss of generality, we consider the first two commodities produced by the first two processes. If they happen to have the same cost of production (which is, of course, not a necessary assumption but a convenient one for the use of this graphic technique), their relative price is given by (p_1, p_2). The vector (p_1, p_2) will be orthogonal to the difference of the vectors (b_{11}, b_{12}) and (b_{21}, b_{22}) (*fig.* 3).

This consideration suggests that a "square" Sraffa system emerges if demand is given in the form of a basket of final goods to be produced and if there is a large number of processes from which the methods to be used can be selected. If needs are given in rigid proportions (for the reasons mentioned above), at least as many processes will in general be needed as there are commodities to be produced in the required proportions (without overproduction). But, on the other hand, not more processes can be used in an equilibrium with a uniform rate of profit, for otherwise prices would be overdetermined.

The idea has here been illustrated by means of a simple diagram based on a narrow assumption which excludes the most important considera-

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tion. It has assumed that costs of production are given so that the interdependence has been neglected between the "demand-side" of the Sraffa system (output prices on the right-hand side) on the one hand the
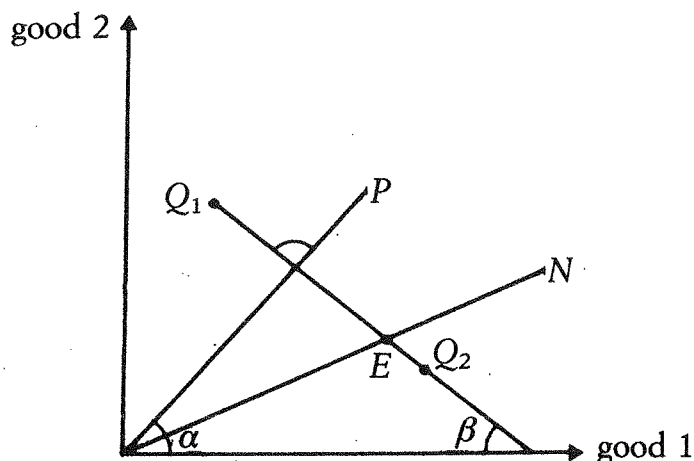
good 2

Q_1

P

N

E Q_2

α β

good 1

Fig. 3. Needs given in fixed proportions N. Generic solution at E involves two processes Q_1, Q_2 producing two commodities. $Q_1 = (b_{11}, b_{12})$, $Q_2 = (b_{21}, b_{22})$. Price vector $P = (p_1, p_2)$; tan $\alpha = p_2/p_1$, tan $\beta = p_1/p_2$.

"cost of production-aspect" (supply-side, left-hand input prices) on the other.

It can be proved rigorously that a "square" Sraffa system will emerge with probability one on a golden rule path, if a vector of final demand is given. Among all square systems which can be obtained from a finite set of feasible alternatives and which allow to produce (or partly overproduce) the given basket of goods, the one that yields the highest real wage, given the rate of profit will be chosen. The envelope of these wage curves is monotonically decreasing. The problems in extending this result to the more plausible case where the rate of profit is larger than the rate of growth or to non-proportional growth has not been explored fully yet but the substance of the argument seems to be valid from a mathematical point of view[32].

Sraffa, however, does not approach the problem of joint production from this angle. Instead of optimizing and looking for an equilibrium

[32] Cf. B. SCHEFOLD, "On Counting Equations", *op. cit.*; N. SALVADORI, "Existence of Cost Minimizing Systems", *op. cit.*; C. BIDARD (ed.), *La production jointe. Nouveaux débats*, Paris, Economica, 1984.

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among a number of feasible alternatives, he takes a square system as given and performs his mental experiment of observing what happens to relative prices as distribution changes. This leads to many complications because of the possible occurrence of negative prices (to be eliminated by means of truncation) and other effects, which have been studied extensively in the literature. But the main interest in the model is elsewhere.

First of all, Sraffa's method corresponds to the classical approach to the problem of accumulation: The system is taken as given and one examines the conditions under which it may reproduce itself. The question of how other methods may be chosen is to be treated subsequently (in particular, the idea of having a long list of blueprints is problematical because it is difficult to assess and to compare the costs of actual and of potential techniques). It is of particular interest to observe the effects of changes in one method of production on prices and quantities in a square joint production Sraffa system, for there may be effects which are qualitatively different from those observed in single product systems. For instance, an increase in the productivity of labour in one sector of the economy always leads to a fall of all prices in terms of the wage rate in a basic single product Sraffa system, whereas the same need not be true for joint production[33]. Or, if there is a profit contribution from the selling of a by-product which had previously not been a commodity, it will generate a revenue such that all prices fall, if the new commodity is produced in indispensable processes, but some prices may rise and some fall if the process is not indispensable.

This indicates that it would be desirable to construct square joint production output matrices so as to enlarge input-output analysis in order to detect such effects which will always remain concealed as long as joint production is eliminated by means of aggregation procedures in applied economics.

It is clear, at any rate, that alleged difficulties with "demand" are no reason to reject the classical theory of value from a theoretical point of view. By assuming an equality of the number of processes with the number of commodities, Sraffa has indicated a way to determine relative prices in the case of joint production in exactly the same way as in single product systems, i.e. by taking the needs and the methods of production to satisfy them as given. Changes of the system can be analysed in consecutive steps. In particular, small changes in needs do not have to lead to an immediate change in the methods of production employed, while exogenous changes in the method of production are compatible with a satisfaction of the same needs. Thus, one can analyse continuous changes in the composition of

[33] Cf. my "Multiple Product Techniques with Properties of Single Product Systems", *Zeitschrift für Nationalökonomie*, 38, 1978, pp. 29-53.

output, arising from the growth of incomes, with gradual (stepwise) changes in methods of production in response to shifts in demand or engendered by technical progress. E.g., it is possible to increase the proportion of wool to mutton continuously by raising the average age of a flock of sheep. Since live sheep of age t can be treated as fixed capital yielding wool and $t + 1$ year old sheep as joint products, with the T year old sheep being transformed into mutton, this can be achieved by increasing T by one step for an increasing number of sheep.

If this settles the question of the logical consistency of the classical approach at least provisionally in that it has been shown that square systems determine prices and are compatible with changes in the composition of output, there remains the contrast between the main hypothesis of an equality of the number of commodities produced and the number of processes used on the one hand and the apparently frequent occurrence of an inequality on the other. It may either be due to an overdetermination of prices because of competing processes or to an apparent underdetermination in those cases where there is one process yielding multiple products and no other processes are visible which might help to determine the relative prices.

In my view, such cases of overdetermination or underdetermination are quite real and frequent, and the practice of business administration would not be explicable otherwise. But both overdetermination and underdetermination can be explained in terms of a classical theory of disequilibrium; they are aspects of processes of gravitation of market prices towards prices of production. I have illustrated the thesis systematically and by means of concrete examples in a recent work[34]; the result can be summarized as follows:

The normal case (even with single product industries) is that of a multiplicity of methods of production which compete in one or, in the case of joint production, in a restricted number of separate markets. The prices are then formally overdetermined. The practical result is that rates of profits differ. The multiplicity of processes may persist if surplus profits are consolidated as rents and accrue to those who control the causes for the permanence of the multiplicity of methods. Not only land, but also patents or even certain components of wages are cases in point. The surplus profits are temporary and will tend to disappear in the case of technical progress with unrestricted competition. But the principle extends beyond the sphere of industrial commodity production; in some cases a limit to prices may be provided by the costs of domestic production (e.g. processed industrial vs. homemade foods). Many phenomena of the neoclassical theory of imperfect competition have here

[34] See B. SCHEFOLD, "Sraffa and Applied Economics", op. cit.

their logical place in a classical system. For instance, product differentiation can — but need not be — a way to legitimate unequal prices due to unequal costs of production, and it is then formally compatible even with equal rates of profit in a high cost and a low cost firm.

There are therefore many interesting forms of overdetermination which can be analysed by means of various models, but the problem of overdetermination as such is by no means new but has always been present in the classical vision. The converse case where there are not enough processes to determine prices according to Sraffa's method is more intriguing. It is best to look at this matter by assuming that there is one method of production, producing a single commodity, and that then a by-product is discovered which had previously been disposed of as a waste but which now can be used either as an input to some other process or as a consumption good. It can then only rarely be expected that another process is discovered in which the rôles of the by-product and the main product are reversed so that they can be combined to yield the appropriate quantities. Often, additional processes will use one of the products as an input and thereby determine its value. The main possibilities are:

1. Either the original process, run at its original level, provides more than enough of the by-product so that this will not acquire a price and become a commodity if disposal is free. If disposal is costly, the producer of the by-product pays for the service of a firm which is prepared to take it over. Part of it is still disposed of; that amount for which there is a social need will be processed and sold at a price which is normally equal to the cost of processing the amount used *minus* what it would have cost to dispose of it.

2. Or the original process, run at its original level, does not provide enough of the by-product. It is then either expanded to the level required by the need for the by-product. In consequence, one should expect the original product to be overproduced and to receive a zero price or to result in a disposal cost (case $2a$). However, the cheapening of the original product, with its established market, may also lead to the discovery of new uses for it in industrial (case $2b$) or in domestic processes of production (case $2c$). Or, finally, the original process is not expanded; the excess demand for the by-product will then have to be satisfied by an additional process (case $2d$).

In formulae, one obtains for case 1

$$K_1 = Mp_M + B_1p_B$$

$$K_2 + (1 + r) B_2p_B = 0$$

$$K_3 + (1 + r) B_3p_B = Cp_c$$

where K_1, K_2, K_3 respectively are the costs (including wages and profits) of the original process (producing the main product M at price p_M and the by-product B_1 at price p_B), of the waste-disposal process (which produces no commodity by means of the quantity B_2 of the by-product to be disposed of) and of the process yielding a useful commodity C at price p_c, manufactured from the quantity $B_3 = B_1 - B_2$ of the by-product. If costs are given, the number of unknowns (p_M, p_B, p_C) is equal to that of the equations. Note that p_B is negative, while p_c and p_M are positive coefficients. The analysis transcends the conventional approach insofar as truncation is ruled out (the pollution abatement process is imposed so that a negative price obtains).

Case $2a$ is similar. The point of the theory, however, now is that the fall in the market price of the main product, due to the necessity of expanding the original process above the level at which it had previously been run, in cases $2b$ and $2c$, is an incentive to introduce new processes which will eventually lead to the determination of the unknown price unless the solution, according to case $2d$, makes such an expansion unnecessary. If, to illustrate ($2d$), the importance of a by-product of a large industrial process is discovered, it is possible that it — or a close substitute — can also be manufactured directly, and this cost of manufacturing will then determine the price at which the by-product and, consequently, the main-product can be sold.

But if the original process is expanded and the market price of the main product falls, its price may also be determined on the input side, for if its new use is to produce some other commodity by a new method which had already been produced in some other process at known costs, its price may fall from its original level to the point at which it will make the new process profitable ($2b$). If the demand for steaks increases relative to that for other forms of meat used in more traditional cooking, more cattle will be slaughtered, more meat will be processed and more hamburgers will have to be marketed. (The hamburgers represent the additional process). Or, if more gas is to be produced from coal, coke will be processed to briquettes.

It is possible that the additional process is introduced by the households themselves, and this is perhaps the less familiar case ($2c$). Increased consumption of a commodity thanks to its reduced price does not have to lead to a change of needs or habits. If, for istance, the price of electricity at night is lowered because of new forms of power stations, the answer of households may be to introduce domestic storage heating which allows them to accumulate heat at night and to release it during the day. Since the cost of direct (central) heating by means of oil is given, this activity determines the value of night-time electricity to households. In such cases, a domestic method of production may, by contrast with what has been said in section 3 about single product systems, influence the basic

system. In the example, the value of storage heating influences the price of night time electricity, the latter that of day time electricity, and both forms of electricity are basic commodities.

The answer to cheaper electricity at night is not to start cooking at bed-time. We do not have to postulate that needs are responsive to price changes. Indeed, if the original good and the by-product were immediate substitutes for the same need, like big and small apples, they could be treated as the same good.

The multiplicity of potential methods of production, which has here been invoked to explain how prices of production can be determined in the face of an apparent underdetermination, is greatly enhanced if we remember the fact that most processes of production are not rigid in that some substitution between outputs is possible. In order to take this into account, one could allow the input-output coefficients to vary continuously in function of some parameter, but it seems more convenient to use a linear approximation, by means of a finite number of separate activities, to transformation curves (where they exist).

It follows that the tendency towards an underdetermination of prices is replaced by a tendency towards an overdetermination with many methods competing against each other, and with a differentiation of rates of profit. The square Sraffa system may be regarded as the result of the corresponding competitive process. But, for theoretical as well as applied analyses, it is often better to take it as the starting point and to regard the methods employed in the system, from which one starts, as given and socially necessary, either by using averages between existing techniques or by taking least-cost techniques as the point of departure. One may then consider how the socially necessary technique shifts, or which other methods might become socially necessary, according to projections about productivity growth, expected changes of distributive parameters and other outside influences such as policies for research and development.

We may conclude that, in spite of specific effects, changes in the composition of output can be discussed in the presence of joint production in essentially the same way as in single product systems.

5. VARIABLE RETURNS AND TECHNICAL PROGRESS

We return to single product systems in order to investigate how our considerations are affected by variable returns. We want to show that the dependence of the cost of production on the scale of output does not require a different consideration of the rôle of demand. In particular, variable returns do not lead to supply schedules to be matched by demand curves.

As is well known, Sraffa discussed diminishing returns, taking the

familiar example of land in a Ricardian setting. As in Ricardo, there is not only differential rent of the extensive kind, due to the expansion of cultivation from better to inferior lands — ordered using prices at a given rate of profit —, but also intensive rent due to the coexistence of two different methods of production for one commodity on one and the same land. In the latter case, one method is, at the given prices, more land-intensive, the other more cost-intensive (where costs include wages and capital with normal profits). An expansion of cultivation may now take place if the cost-intensive technique (which must have a higher productivity per unit area to be eligible) is gradually extended at the expense of the land-intensive technique which has lower costs but requires more land per unit of output. As soon as the more productive technique covers the entire area, a new, yet more productive technique must come in. In this way, production may rise continuously, while rent rises spasmodically. For each step, there are constant returns with a given technology, but total unit costs rise as production expands and techniques change[35]. Sraffa emphasizes that the order of fertility of different lands in the case of extensive rent and the ordering of techniques according to cost-intensity in the case of intensive rent cannot be given independently of prices, and hence of distribution.

If several crops can be grown on different lands, curious patterns of specialisation of lands are possible at a given rate of profit[36], and the superposition of joint production can cause rents to fall as well as to rise with the expansion of production on one particular piece of land because of the interrelationships with other lands[37].

If there is only one crop to be grown in a single product system, there results, at the given rate of profit, a stepwise rise of the price of the crop. It can be drawn in a diagram, with its discontinuities, in function of output (*fig.* 4). The graph looks very much like a neoclassical supply curve to be matched by a demand curve, but it is a different construction.

A neoclassical supply curve is *either* drawn as a partial equilibrium curve. Factor prices must then be considered as given in order to calculate the costs associated with different levels of the output of the good under consideration. The marginal cost curve so constructed is matched with a demand curve to obtain the equilibrium in one market. However, the demand curve and the supply curve are, strictly speaking, interdependent because, with different levels of demand, there might be associated different factor prices. For instance, if the good under consideration is

[35] B. Schefold, *Piero Sraffas Theorie der Kuppelproduktion, op. cit.*

[36] *Ibid.*

[37] P. Saucier, "Le choix de techniques en situation de limitations de ressources", *Thèse pour le doctorat d'état*, Université de Paris II, 1981, p. 278.
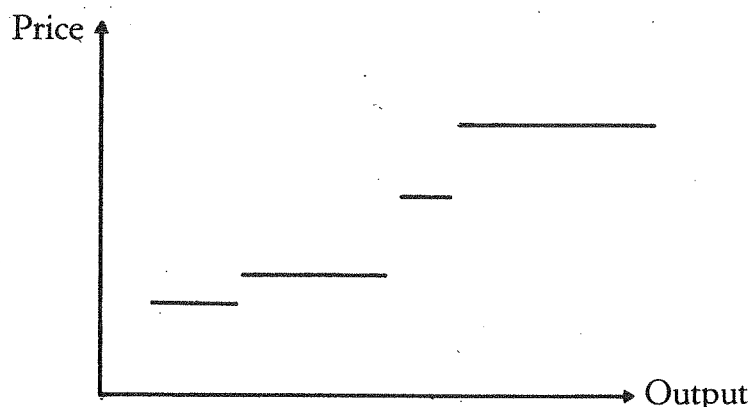
Fig. 4. Output of crop and price with extension of cultivation over different types of land for a given rate of profit.

a consumption good, a higher price for it may change the supply of labour[38].

Or the full interdependence of markets is taken into account and the general equilibrium of demands and supplies of all goods is considered. But then, the supply curve usually disappears from the argument because there is, ideally, only one equilibrium point to be determined in the space of all quantities and prices. This point may shift if an exogenous parameter of equilibrium such as population changes. If population increases, the equilibrium point will follow a trajectory (as in the neoclassical one sector growth model), and to this the above construction in diagram 4 may best be compared. For the change in the composition of output discussed by Ricardo and reflected in the more formal consideration of Sraffa concerns a particular scenario: Population increases, accumulation goes on and output is expanded. Ricardo showed (first in his essay on corn of 1815[39]) that the rate of profit will fall, if the real wage contains agricultural products, if methods of production are not improved over time, if overall productivity diminishes with an expansion to inferior lands, and if the real wage is given. Sraffa's treatment, dissociated from this historical context, takes the rate of profit as the independent variable. The interaction of markets can be taken into account (the good considered need not be a non-basic) and yet the rising curve can be derived, under simple

[38] Cf. P. Sraffa, "Sulle relazioni fra costo e quantità prodotta", *Annali di Economia*, Vol. II, 1, 1925.

[39] D. Ricardo, "An Essay on the Influence of a low Price of Corn on the Profits of Stocks" (1815), *The Works and Correspondence of David Ricardo*, ed. by P. Sraffa, IV, Cambridge, Cambridge University Press, 1951/1966, pp. 9-41.

assumptions, because full employment is not assumed and distribution is taken as given. The curve is therefore not a supply curve in the sense of the neoclassical textbooks, because the theory as a whole has not been subdivided into that of partial and of general equilibrium as in neoclassical theory but in that of a theory of value, given outputs and techniques of production on the one hand, and in theories of output, of technical progress and of distribution on the other. Whether the case is a legitimate representation of a rise in price in a process of growth therefore depends on the extent to which the supposed conditions regarding distribution and demand (and of course the technologies available) remain unchanged (Ricardo's point, of course, was simply to show that they eventually had to change — he could not say exactly how).

The neoclassical equilibrium trajectory for such a Ricardian scenario would be much more difficult to obtain because full employment would have to be assumed as the exogenous parameter (population) changes so that factor prices would be affected. For instance, the increase of population relative to a given factor endowment of land might lead to a fall of real wages which would counteract rising land rents, with an uncertain overall result on the price of the agricultural product even in the absence of the more complicated effects discussed in the capital theory debate.

Matters are different in the case of technical progress and also in that of increasing returns (the latter are really inseparable from the former). A curve showing prices, at outputs corresponding to successive long period positions, depicts only a specific, irreversible historical process and will in general not be expected to hold if accumulation were to be turned backwards because of an exogenous destruction of capital or in a depression. Yet, a schedule can be drawn as an ex-post description of the development of the price of production in any one market or as an estimate even in the presence of technical progress; to this extent, *fig.* 5 is analogous to *fig.* 4.

The increasing returns to scale traditionally associated with an increase in the division of labour are difficult to distinguish from other forms of making labour more productive by reducing the direct labour input. Economists of the classical and the historical school have attempted to give phenomenological descriptions of different forms of the division of labour; the pin factory of Adam Smith and the chapter on the production of relative surplus value in Marx are the standard references, but Karl Bücher provided perhaps the most extensive account[40]. The price of production at a uniform rate of profit can in principle be calculated even if the firms enjoy advantages of scale. It may well be that the rates of profit in

[40] See K. Bücher, *Die Entstehung der Volkswirtschaft* (1893), 6th ed., Tübingen, Verlag der Laupp'schen Buchhandlung, 1906.
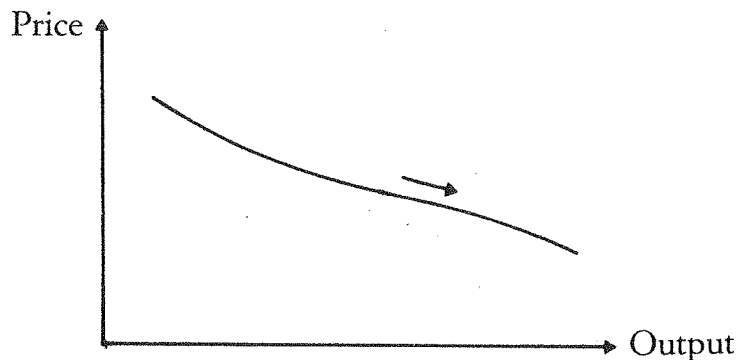
Price ↑

Fig. 5. Increasing returns causing a falling price of production with output expanding in a given industry at a given rate of profit.

the corresponding sectors, calculated as some average of the market prices, will tend to be higher. But, according to classical arguments which have reappeared in the theory of workable competition, full monopolies are not likely to develop and any form of competition which results can be discussed with reference to the prices of production. As was stressed earlier, it is possible that mark-ups are such that prices set by firms are equal to prices of production, that short run disturbances are smoothed through changes in stocks and orderbooks and that competitive pressures are exerted more through product differentiation, marketing, and research and development than through price cutting.

A more formal treatment of how the price of production changes with increases of output can be obtained if it is assumed that the changes in technology are known or can be projected at the level of the input-output coefficients. Various research institutions publish forecasts of changes of direct labour productivities for the important sectors of the economy at the level of aggregation of input-output analysis. Searching for the relevant coefficients by means of sensitivity analysis, one can also try to obtain estimates of expected changes of key input-output coefficients by experts of individual industries and take those into account at some intermediate level of aggregation. Speaking more theoretically, different forms of technical progress can be distinguished conceptually[41], and the effect of a steady flow of technical changes can be expressed by calculating the impact on normal costs.

I suggest that classical analysis provides a theoretical rationalization of what economists mean when they talk, for instance, about the future price

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[41] See my "Different Forms of Technical Progress", *op. cit.*

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of grain, cars or computers some years hence, be it in terms of educated intuitive guesses or aided by statistics and econometric models. For they will want to talk about future prices in relation to some "normal" level of profitability and output. They will probably not want to hazard guesses about the consequences of a change in the distribution of income, but if they do, they will discuss a change by considering the unusual circumstances which bring it about along with other important institutional factors which may have to be taken into account. Hence they will follow the classical methodology of estimating normal prices, given the expected changes of quantities, in particular of the technology, and they will not be following a strict neoclassical methodology because that would involve a simultaneous consideration of changes in factor prices at full employment.

It follows that increasing and diminushing returns do not give rise to supply curves to be matched by demand curves but that to each stage in the process of accumulation there corresponds a level of output of each industry which allows demand to be satisfied. Changes in the relative composition of output will accompany the expansion; their macroeconomic consequences may be diverse, as discussed in section 3. Variable returns are no reason to abandon the classical method.

CONCLUSION

We have now analysed the interaction between the theories of value and of output in several subsequent steps. It was first argued that individual choice is likely to be often inconsistent but that there are social rôles to be fulfilled. We have regarded needs as given because they can be associated with social groups, because individuals are likely to stick to habits and conventions in the face of conflicting influences and because there is a structure to the system of consumption. We saw how households, having different methods to produce the goods they require to satisfy their needs, adapt to exogenous changes in prices and incomes, and what macroeconomic consequences might follow according to the surplus approach. We then showed that extensions do not alter the conclusion although they give rise to special phenomena such as (in the case of joint production) the search for methods of production to adapt the composition of output to given needs and (in the case of variable returns) the (false) appearance of supply curves.

The approach allows us to focus on the needs in a stratified society directly, without the intervention of utility functions or preference systems. The underlying methodological separation of the theories of value, distribution and output will not easily be overcome in a unified, formally closed theory, but this is no drawback if a sequential analysis is best suited to grasp the essential traits of historically changing economic

problems. In particular, the economics of welfare will then again be concerned with the well-being of concrete social groups, and with the question of what output we want and by which means it is to be produced. The focus is, to use an old concept, on wealth, not on utility, and on representatives of social groups, not on individuals.

From an analytical point of view, the key contention of the paper has been that changes in the composition of output can, in a classical theory, be analysed not only if the conditions of the nonsubstitution theorem are fulfilled but also if there are joint production and variable returns. There is no reason to identify the classical theory with an analysis restricted to "balanced growth" or "steady states" (as Hahn does)[42]. To do so would exclude the possibility of changes in the composition of output which accompany development. The classical theory is not a special case of the neoclassical. It clearly was conceived to deal with fundamental economic transformations of the type of the Industrial Revolution, involving non-proportional growth and changes in the composition of output. The theory of value was designed to provide a conceptual foundation for the corresponding social and technical transformations, with the theory of demand being based on an assessment of the cultural change associated with economic progress.

Institut für Markt und Plan
Johann Wolfgang Goethe-Universität, Frankfurt am Main.

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[42] Cf. F. HAHN, "The Neoricardians", *Cambridge Journal of Economics*, 6, 1982, pp. 353-374.