Shaikh, A. (1976), "The Influence of Inter-Industrial Structure of Production on the Relative Prices", New York, mimeo.
Shaikh, A. (1978), "Political Economy of Capitalism. Notes on Dobb's Theory of Crisis", *Cambridge Journal of Economics*, vol. 2, no. 2.
Shaikh, A. (1980), "Marxian Competition versus Perfect Competition: Further Comments on the so called Choice of Technique", *Cambridge Journal of Economics*, vol. 4, no. 1.
Smale, S. (1981), Global Analysis and Economics, in: K.J. Arrow and M.D. Intriligator (eds), Handbook of Mathematical Economics, vol. I, (Amsterdam: North-Holland Publishing Comp.).
Smith, A. (1961), *The Wealth of Nations*, (London: Methuen).
Sraffa, P. (1960), *Production of Commodities by Means of Commodities*, (Cambridge: Cambridge University Press).
Steedman, I. (1979), *Trade amongst Growing Economics*, (Cambridge: Cambridge University Press).
Stigler, G.J. (1957), "Perfect Competition, Historically Contemplated", *Journal of Political Economy*, vol. 67.
Teplitz, W. (1977), "Werte und Tausch im Kapitalismus", *Mehrwert*, no. 13.
Varian, H.R. (1977), "Non-Walrasian Equilibria", *Econometrica*, vol. 45, no. 3.
Varian, H.R. (1981), Dynamical Systems with Applications to Economics in: H.J. Arrow and M.D. Intriligator (eds), Handbook of Mathematical Economics, vol. I, (Amsterdam: North-Holland Publishing Comp.).
Voievodien, V. (1980), *Principles Numeriques d'Algèbre Linéare*, (Moscou: Editions Mir).

[10]

NATURAL PRICES, DIFFERENTIAL PROFIT RATES AND THE CLASSICAL COMPETITIVE PROCESS*

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Few would question the centrality in classical economic theory of the idea that the mobility of capital (and labour) between industries tends both to bring about a uniformity of rates of profit and to drive the market prices of commodities towards the corresponding natural prices. In the first section of this paper the presentations of this idea given by Smith, Ricardo and Marx are briefly reviewed, particular attention being paid to the way in which they associated a positive (negative) deviation of a commodity's market price from its natural price, with a positive (negative) deviation of the corresponding industry's profit rate from the natural rate. That there should be such a positive correlation of price deviations and profit rate deviations is not immediately obvious, since an industry's means of production will themselves be purchased at market, rather than natural, prices. Could it not happen, then, that an industry whose product's market price lies *above* its natural price, purchases as produced inputs commodities whose market prices lie "even more above" their natural prices, with the result that that industry has a profit rate *below* the natural rate? In the second section of this paper, it is demonstrated that it could indeed happen. In order to simplify the discussion and to focus on one issue at a time, however, that demonstration is given not in the context of a competitive process but in the context of an unchanging economy in which each industry earns a different rate of profit. Having shown that price deviations and profit rate deviations need not be in the same direction, one is naturally led to consider whether the competitive

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process of capital (and labour) allocation will be a stable process, which question is the topic of the third section. This question is clearly important in view of the renewed interest in the classical conception of natural prices as "centres of gravitation".

1 Smith, Ricardo and Marx

Smith.[1] Consider first the picture of the competitive process presented by Smith (1982) in Book I, Chapters VII and X.[2] Smith's argument, with respect to what is happening in any particular industry, is based on the assumption that the *natural* levels of prices, wages, profit rates and rents are *given* and independent of the events considered in that industry (p. 72).[3] The market price of the product of an industry depends on the current quantity brought to market, relative to the "effectual demand", which is the quantity demanded at the commodity's natural price (p. 73).[4] If the quantity brought to market should fall short of the effectual demand, the market price will rise above the natural price (pp. 73–4) but "The quantity of every commodity brought to market naturally suits itself to the effectual demand" (p. 74). It does so because if, for example, the market price of a commodity lies below the natural price then the wage and/or the profit rate and/or the rent paid in the industry must fall below the natural rate and hence labour and/or stock and/or land will be withdrawn from the industry, the quantity brought to market will fall and "The quantity brought to market will soon be no more than sufficient to supply the effectual demand" (p. 75). The opposite occurs if "the quantity brought to market should at any time fall short of the effectual demand" (p. 75). "The natural price, therefore, is, as it were, the central price to which the prices of all commodities are continually gravitating" (p. 75). By the same token, under "perfect liberty" wages, profit rates and rents—allowing for non-pecuniary (dis-)advantages—will be "continually tending to equality" (p. 116).

Smith notes too a number of conditions of and qualifications to the process just outlined. Thus, under perfect liberty, a market price cannot lie *below* the natural price for as long a time as it might lie above it (p. 79) and the perishability/storability of a commodity influences the relation between

[1] It is not, of course, implied that Smith was the first to suggest the natural price-market price adjustment process—see, e.g., McNulty (1967), who refers to, amongst others, Cantillon, Turgot, Hume and Steuart.

[2] See Richardson (1975) for the argument that the *Wealth of Nations also* contains a wider-ranging vision of the competitive process.

[3] C.f. Hollander (1973, pp. 117, 122).

[4] Given, presumably, that all other commodity prices are also at their natural levels, along with wages, profit rates and rents.

its current production and the quantity of it which is brought to market (p. 74). The deviations of market from natural price can be expected to be greater for agricultural products than for manufactures (pp. 75–6) and price variations are likely to cause smaller variations in rents than they do in wages or profit rates (p. 76). The equalizing force of the competitive process will depend both on how widespread is the relevant knowledge and experience —which is why attempts will be made to keep secret both increases in effectual demand and improvements in methods of production—(pp. 77, 131–2) and on the numbers of competitors (pp. 301–2, 525–6).

Three points should be noted. The first is that Smith always takes market price deviations to be *positively* correlated to industry wage, profit rate and rent deviations; the second is that he relates the movements of labour, stock and land *directly* to these latter deviations—it is only by implication that "factor" movements are related to the market price deviations for products. Hence if it could be shown that market price deviations for products might *not* always be positively related to industry wage, profit rate and rent deviations, it would be plausible to suppose that Smith "would have" maintained the relation which he directly asserts and abandoned that which he only implies. The third point is that Smith is able to suppose that product market price deviations are always positively related to industry wage, profit rate and rent deviations only if he assumes that *all other* product prices are at their natural levels (see below). Now this is a curious assumption, given his recognition that the market prices of agricultural products will often differ markedly from their natural prices, for such products will constitute the *inputs* purchased by many farmers and manufacturers. How then can it be appropriate to analyse the working of the competitive process in every particular industry on the assumption that *all* other relevant prices are at their natural levels?[5]

Ricardo. The various accounts of the competitive process given by Ricardo (1951 *et seq.*)[6] appear to be fully consistent with that of Smith, as briefly set out above; indeed, the closing paragraph of Ricardo's fullest account, in Chapter IV of the *Principles*, begins with the assurance that "In the 7th chap. of the Wealth of Nations, all that concerns this question is most ably treated" (I, p. 91). Apart from that chapter in its entirety, one may refer to (I, pp. 62, 119, 259, 291n, 307, 312–3, 415–16; III, p. 165; IV, pp. 21–5), amongst many statements of Ricardo's view. Ricardo supposes that market

[5] For some recent discussions of Smith's theory of natural and market prices, see Arena (1978); Benetti (1979); *Cahiers d'Économie Politique* (1981); *Studien zur Entwicklung usw* (1981).

[6] References to the Sraffa edition of Ricardo's *Works and Correspondence* will be given by means of volume numbers followed by page numbers.

price deviations are positively related to industry profit rate deviations and that capital will flow so as to make profit rates uniform – account having been taken of non-pecuniary (dis-)advantages (I, pp. 89–90). He notes the role of bankers and of the "monied class" in effecting the reallocation of capital (I, p. 89) but is well aware that the speed and ease of adjustment will vary from one industry to another (I, pp. 191, 196, 269; II, p. 351). That the competitive process depends on sufficiently widespread knowledge of the conditions in each activity is made explicit in Ricardo's remarks on the discovery of new export markets, of new sources of imports and of new machines (IV, pp. 24–5). Since Ricardo takes it that the second and third types of discovery will, by increasing the industry profit rate *without* raising the market price of its product, lead to an inflow of capital, it is clear that he sees industry profit rates – rather than product market prices – as the proximate stimuli to capital movements.

An interesting light on Ricardo's views is shed by his letter of 26th September, 1820, to Trower. Ricardo asks "whether [corn, iron, silk, wine, &c. &c.] are not all produced on account of an actual or expected demand for them, and whether this demand is not always indicated by the relation of the market price to the natural price?" (VIII, pp. 255–6) and goes on to suggest a positive answer to both questions. He states that "What all producers look steadily at is market price, and its relation to natural price" (p. 256) and then strongly suggests that market *prices*, relative to natural prices, are the proper guide to the allocation of new investment. He ends his letter, however, stating that "High profits are the consequence of high price" (p. 259), implying that his earlier stress on market prices, relative to natural prices, was only an indirect way of referring to deviations of industry *profit rates* from the natural rate.[7]

Marx. Accounts of the competitive process, similar to those of Smith and Ricardo, can be found both in Marx's early work *Wage Labour and Capital*, of 1849, and in *Capital*, Volume III. In that early work, Marx writes: "What will be the consequence of the rising price of a commodity? A mass of capital will be thrown into that flourishing branch of industry and this influx of capital . . . will continue until it yields the ordinary profits or, rather, until the price of its products, through overproduction, sinks below the cost of production. Conversely, if the price of a commodity falls below its cost of production, capital will be withdrawn from the production of this commodity" (1973, pp. 156–7). (Marx writes "or, rather, until . . ." because he takes "overshooting" to be the normal reaction to any deviation of market

[7]For J. S. Mill's account of the competitive process, see Book II, Chapter XV, Section 4 and Book III, Chapter III of his *Principles* (1891, pp. 283–5, 308–12).

price from cost of production (p. 157). It will be noted that, in this passage, Marx takes it for granted that market price deviations are *positively* related to profit rate deviations from the "ordinary" rate.

The same assumption is made in *Capital*, Volume III. Thus Marx writes: "But capital withdraws from a sphere with a low rate of profit and invades others, which yield a higher profit. Through this incessant outflow and influx . . . which depends on how the rate of profit falls here and rises there, it creates such a ratio of supply to demand that the average profit in the various spheres of production becomes the same" (1966, p. 195). After repeating this almost verbatim (p. 208), he continues directly: "This movement of capitals is primarily caused by the level of market-prices, which lift profits above the general average in one place and depress them below it in another" (p. 208). Marx notes that the general speed with which profit rates are equalized depends on the degree of mobility of capital and labour (p. 196) and that the process will be rapid for merchants but slower for producers, the relative use of fixed capital being a significant factor (p. 208).[8]

Stigler (1967, pp. 238–9, 241n.14) notes that Senior and Cliffe Leslie expressed definite doubts as to the plausibility of the assumptions, concerning mobility and the diffusion of knowledge, which underlie the view of the competitive process attributed above to Smith, Ricardo and Marx.[9] Our concern in the following two sections is not, however, with questions of plausibility, or realism, but with questions of internal coherence.

II Price Deviations and Profit Deviations

The present section constitutes a prelude to the consideration of stability presented in Section III and highlights the importance of a stability analysis by showing that the deviations of market prices from natural prices need not be positively correlated with the deviations of industry profit rates from the natural rate, in the presence of produced means of production. This means, of course, that a particular industry with a "high" profit rate may be attracting extra capital when it is *already* more than meeting its effectual demand and is thus receiving a "low" market price for its product.

When we turn to the stability question in Section III, it will naturally be assumed that the prices at which commodities are purchased as inputs, at the beginning of a production period, may differ from those at which commodities are sold as products, at the end of that period. For our present limited purpose, however, it suffices to suppose that those two sets of prices

[8]Recent discussions of Marx's treatment of the competitive adjustment process may be found in *Cahiers d'Économie Politique* (1981).

[9]See also Arena (1982, pp. 146–149) for a discussion of Sismondi's doubts, in his *Nouveaux principes d'économie politique*, concerning the classical adjustment process.

are the same, simply being different from the natural prices which correspond to a uniform rate of profit. All elements of change and of process are ruled out, *in this section*, and we proceed by considering how the relative prices obtaining with differential profit rates[10] compare with competitive, or natural, relative prices. For ease of reference, the former case will be referred to as the "monopoly" case; and, indeed, that name suggests that the present discussion may have an intrinsic interest, as well as being a prelude to Section III.

This comparison will be made in the extremely simple context of an n-commodity, closed economy, in which each commodity is produced in a "year", by just one single-product, circulating-capital method of production. The *absolute* levels of all inputs and outputs will be held constant as between the competitive and monopoly situations.[11] In order to focus attention on the differential rates of profit, rent will be ignored and the basis of comparison will lie in holding the real wage constant as between the two situations. It will be assumed initially that all the commodities are Sraffa basics but non-basics will be introduced later. The use of fixed capital and possibilities of storing produced commodities will both be ignored.

Differential Profit Rates and the Real Wage

Let the gross output of each commodity be unity, by choice of units, and let total employment be unity, similarly. Let the jth column of the square, semi-positive, irreducible matrix $A(\mathbf{a}j)$ represent the absolute input flows to industry j and let the jth entry in the positive row vector $\mathbf{a}(a_j)$ represent employment in that industry. Then if $\mathbf{p}$ is the positive row vector of prices, $\mathbf{z}$ is the semi-positive column vector representing the standard of value and w is the real (*ex-post*) wage rate,

$$\mathbf{pz} = 1 \qquad \ldots\ldots(1)$$

and

$$\mathbf{p} = w\mathbf{a} + \mathbf{p}A(I + \hat{\mathbf{r}}), \qquad \ldots\ldots(2)$$

where $\hat{\mathbf{r}}$ is the diagonal matrix of industry profit rates. From (1), (2)

$$w\mathbf{a}[I - A(I + \hat{\mathbf{r}})]^{-1}\mathbf{z} = 1 \qquad \ldots\ldots(3)$$

defines the $(n + 1)$ dimensional wage-profit rates frontier (for $w > 0$), on which, for given values of any $(n - 1)$ variables, the remaining two variables

[10] Or, more strictly, with differences in rates of profit *additional* to those differences already allowed for by Smith and Ricardo in their definitions of the competitive, or natural, profit rate and of natural prices.

[11] It follows immediately, of course, that our results will hold for any output levels if we add the assumption of constant returns to scale. Whilst the latter assumption is not needed in the present section, it most certainly will be relevant in Section III.

are inversely related.[12] For a *given* (feasible) value of the real wage, $w > 0$, (3) determines *the* competitive profit rate but only defines an n dimensional profit rates frontier in the monopoly situation.

At any point on the wage-profit rates frontier, (2) defines the corresponding prices, in terms of the standard $\mathbf{z}$. More specifically, for a given positive value of w, (3) defines the possible combinations of profit rates and (2) defines the prices corresponding to each such combination. It will be clear that any price ratio, p_i/p_j, is equal to the ratio of two functions of $(r_1, r_2, \ldots, r_n)$.

If $w = 0$, (2) becomes $\mathbf{p} = \mathbf{p}A(I + \hat{\mathbf{r}})$ and thus $\lambda^{PF}[A(I + \hat{\mathbf{r}})] = 1$ — where $\lambda^{PF}[\ ]$ is the Perron-Frobenius root of $[\ ]$ – defines the frontier in $(r_1, r_2, \ldots, r_n)$. If $r_i \equiv R_i$ when all the other r_j's are zero, there is clearly *no* reason to expect that $R_1 = R_2 = \cdots = R_n$. (Of course, $R_i > R^*$ for all i, where R^* is the maximum *competitive* rate.)

Profitability and Prices

If every r_j is positive in (2) then $\mathbf{p}(I - A) = w\,\mathbf{a} + \mathbf{b}$, where $\mathbf{b} > 0$. Hence $\mathbf{p} > w\,\mathbf{a}(I - A)^{-1} = w\,\mathbf{l}$, where $\mathbf{l}$ is the row vector of total, direct and indirect, labour use per unit of net output. That is, profitability in every industry, whether at a uniform rate or not, implies that prices, $\mathbf{p}$, exceed total, direct and indirect, wage costs, $w\,\mathbf{l}$.[13] But the converse obviously does not hold; even if $w = 0$, $\mathbf{p} > 0$ is certainly not sufficient to ensure that $\mathbf{p} > \mathbf{p}\,A$, i.e., that each industry is profitable. To see what *are* the sufficient conditions on prices to ensure profitability, consider first the case $n = 2$. We require

$$a_{21}p_2 \leqslant -w\,a_1 + (1 - a_{11})p_1, \qquad \ldots\ldots(4)$$

to ensure that $r_1 \geqslant 0$, and

$$(1 - a_{22})p_2 \geqslant w\,a_2 + a_{12}p_1, \qquad \ldots\ldots(5)$$

to ensure that $r_2 \geqslant 0$. Consider Fig. 1. In each case, SV shows the (p_1, p_2) satisfying the standard of value equation (1), the line $r_1 = 0$ shows (4) taken as an equality, the line $r_2 = 0$ shows (5) taken as an equality and the shaded region shows the (p_1, p_2) satisfying *both* (4) and (5), i e., ensuring profitability in each industry. The intersection of SV with the shaded region thus shows the prices, in terms of $\mathbf{p.z} = 1$, consistent with profitability, and at one point on that intersection prices will be such that $r_1 = r_2$, i.e., the prices will be the competitive prices. In case (a), the real wage is at its maximum viable level, the intersection is a unique point and $r_1 = r_2 = 0$ is the only possible profitability regime. In case (c), the wage is zero. And in case (b) the real

[12] C.f. Bruno (1969).

[13] As was pointed out by Morishima (1973, p. 71).

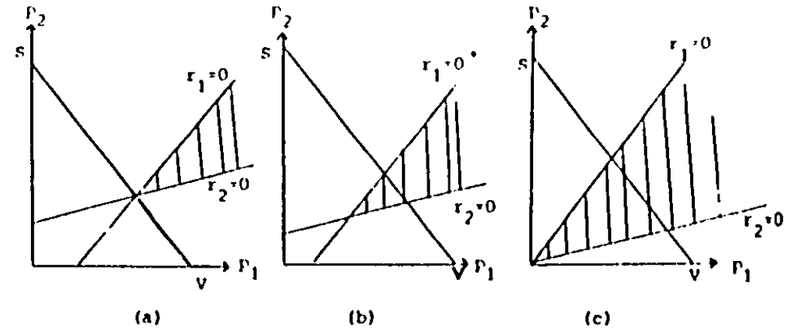

Fig. 1

wage, w, is set at some intermediate level, between zero and the maximum viable level. It will be noted that, the lower is the real wage, the larger is the set of prices consistent with profitability.

Consider now the case $n = 3$; Fig. 2 is precisely analogous to Figs. (1b), (1c). (The point marked k 1 shows what prices would be at the maximum viable real wage rate and the point marked $\mathbf{p}^*$ shows the *competitive* prices at the actual wage rate.) While it is naturally not possible to draw a diagram for the cases $n > 3$, the logic of the general situation will be clear enough.

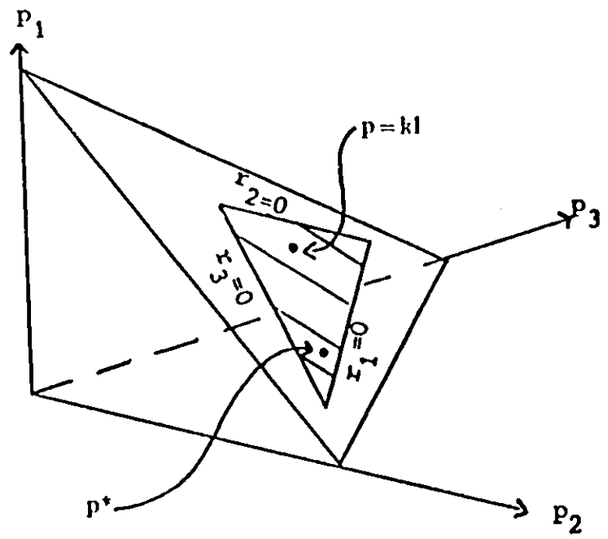

Fig. 2

Monopoly Profit Rates and Prices

Consider a given real wage, in terms of $\mathbf{p}\,\mathbf{z} = 1$, less than its maximum viable level, and denote the corresponding *competitive* prices and profit rate by $\mathbf{p}^*$ and r^*. How will $\mathbf{p}$ change as $\hat{\mathbf{r}}$ moves away from r^*?

In industry j

$$p_j = w a_j + (1 + r_j)(\mathbf{p}\,\mathbf{a}_j)$$

so

$$(\mathbf{p}\,\mathbf{a}_j)\mathrm{d}r_j = dp_j - (1 + r_j)(\mathrm{dp}\mathbf{a}_j), \qquad \ldots\ldots(6)$$

where

$$\mathbf{dp}\,\mathbf{z} = 0. \qquad \ldots\ldots(7)$$

It follows from (6), (7) that $(dr_j \times dp_j)$ is positive if (trivially) $\mathbf{a}_j = \mathbf{0}$; or if a_{jj} is the *only* positive entry in $\mathbf{a}_j$ (since $1 > a_{jj}(1 + r_j)$ if $w > 0$); or if, by a fluke, $\mathrm{pa}_j = \mathbf{p}^*\mathbf{a}_j$; or if, by a fluke, $\mathbf{a}_j$ is proportional to $\mathbf{z}$.[14] In general, however, $(dr_j \times dp_j) \gtrless 0$ is possible. (Except in the trivial case $n = 2$.) There is no *a priori* basis for saying that $r_j \gtrless r^*$ according as $p_j \gtrless p_j^*$: monopoly, in the sense of $r_j > r^*$, may perfectly well be associated with $p_j < p_j^*$. (As the reader may readily verify, the same result is obtained if wages are paid *ex-ante*.)[15,16]

An intuitive explanation of the above result may be noted. To compare the price vectors corresponding to $(1 + r^*)A$ and $A(I + \hat{\mathbf{r}})$, respectively, is formally equivalent to comparing the vectors of direct and indirect labour requirements in two economies with matrices of actual input quantities $(1 + r^*)A$ and $A(I + \hat{\mathbf{r}})$, respectively. Relative to the first economy, the second has experienced uniform "technical progress" in material input use in some industries (when $r_j < r^*$) and uniform "technical regress" in others (when $r_j > r^*$). But it is then hardly surprising if one cannot say *a priori* how (l_i/l_j) will differ as between the two economies.[17]

[14] If $\mathbf{z}$ is taken to be in proportion to the real commodity wage bundle and/or produced inputs are thought to have been relatively unimportant in early capitalism, then it is not difficult to imagine that these conditions might have seemed to be reasonable approximations to Smith and Ricardo.

[15] Analogous results also hold with joint production, if one replaces natural and market prices by natural and market revenues from an activity.

[16] K. Cowling, S. Domberger and N. Salvadori have all suggested that it might be of interest to relate this result to the concept of "the degree of monopoly". I may take up their interesting suggestions elsewhere; here it can only be asserted that the *average* degree of monopoly need not be inversely related to the share of wages in net output, when the degree of monopoly differs as between industries.

[17] I am indebted to J. S. Metcalfe for this analogy. It may be noted that, as U. Krause pointed out to me, differential profit rates can imply deviations of *labour-commanded* prices from their natural levels which differ in sign from the corresponding profit rate deviations. Each labour-commanded price deviation is a positively weighted sum of *all* the profit rate deviations.

An Example

Consider the following technical conditions (where it is now more convenient to assume a total employment of four units).

$$A \equiv \begin{bmatrix} 0 & a_2 & 0 & 0 \\ 0 & 0 & a_3 & 0 \\ 0 & 0 & 0 & a_4 \\ a_1 & 0 & 0 & 0 \end{bmatrix}$$

$$a \equiv (1 \quad 1 \quad 1 \quad 1)$$

A given positive wage in terms of commodity 2 is assumed, so that

$$p_1 = w + a_1 p_4 (1 + r_1)$$
$$1 = w + a_2 p_1 (1 + r_2)$$
$$p_3 = w + a_3 (1 + r_3)$$
$$p_4 = w + a_4 p_3 (1 + r_4).$$

It will be assumed, further, that $r_1 > r_2 > r_3 > r_4$. There are thus *five* possible cases to consider, according to where r^*, the competitive profit rate, lies in the range $r_1 > r^* > r_4$. Each entry in Table I shows how a particular price ratio, (p_i/p_j), compares with the corresponding competitive ratio, (p_i^*/p_j^*). (The columns for (p_4/p_1) and (p_4/p_2) are omitted, since *all* ten entries would be "Lower".) I have underlined those entries in Table I which might not have been "expected" on the basis of pre-Sraffian intuition; note that the industries whose prices are involved in the "unexpected" result do not always have profit rates on opposite sides of r^*. It is clear that one cannot relate monopoly relative prices to monopoly relative profit rates in any simple way.

TABLE I

Case	p_1/p_2	p_3/p_2	p_1/p_3	p_4/p_3
$r_1 > r_2 > r_3 > r^* > r_4$	Lower	Higher	Lower	Lower
$r_1 > r_2 > r^* = r_3 > r_4$	Lower	Same	Lower	Lower
$r_1 > r_2 > r^* > r_3 > r_4$	Lower	Lower	?	?
$r_1 > r_2 = r^* > r_3 > r_4$	Same	Lower	Higher	?
$r_1 > r^* > r_2 > r_3 > r_4$	Higher	Lower	Higher	?

Basics and Non-Basics

The root of the above results concerning relative profit rates and relative prices is to be found in the fact that, for a *basic* commodity, a change in its price involves, *ipso facto*, a change in its "cost of production".[18] It may be expected, then, that matters will be more simple with respect to non-basics. Suppose that (A, a) can be partitioned as follows, where 1 refers to basics and 2 to non-basics:

[18] This was precisely Sraffa's reason for avoiding the term "cost of production" in the context of basic commodities (1960, §7).

$$A \equiv \begin{bmatrix} A_1 & A_2 \\ 0 & 0 \end{bmatrix}$$

$$a \equiv [a_1, a_2].$$

A_1 is assumed to be irreducible. In an obvious notation, *labour-commanded* prices are given by

$$p_1 = a_1 [I - A_1(I + \hat{r}_1)]^{-1}$$

and

$$p_{2j} = a_{2j} + (p_1 a_{2j})(1 + r_{2j})$$

The real wage, however measured, will be falling with respect to each basic industry profit rate but whether it will fall with r_{2j} will depend on whether the jth non-basic enters the standard in terms of which the real wage is measured. (C.f. Targetti, 1978, pp. 125-7.)

Suppose that the real wage rate and the basic industry profit rates are given and suppose that r_{2j} can vary, either because non-basic commodity j does not enter the standard or because, even though it does so enter, so also does some other non-basic. An increase in r_{2j} will obviously raise p_{2j} relative to the price of *every* basic commodity—the "expected" result. If r_{2k} can also vary, it is clear that (p_{2j}/p_{2k}) will be rising in r_{2j} and falling in r_{2k}—the "expected" result again. Suppose now, however, that the lower right-hand null matrix in A above is replaced by a semi-positive matrix A_4, so that some non-basics are used as inputs in the production of at least some non-basics. If wages are paid in advance and if the real wage rate and the basics profit rates are all given then, for a group of three or more inter-connected non-basics, the analysis of relative prices and relative profit rates is *formally* the same as for a group of basic commodities (with wages paid *ex-ante*). For the non-basics in question, the wage bills *plus* the capital advances for basic inputs can be treated simply as "augmented" wage bills and the analysis is, as just asserted, equivalent to that carried out in the section *Monopoly Profit Rates and Prices*, above. In this case then, even the relative prices of non-basics cannot be related in any simple way to relative profit rates under monopoly conditions.

Price and Profit Deviations

It has been shown in this section that, under certain simple assumptions, one cannot safely associate "high" product prices with "high" industry profit rates, in an economy in which produced means of production are important.[19] The reason for this is essentially simple; when commodities are produced by means of commodities, their "prices" and their "costs of production" are not independent. While the argument has been restricted to a

[19] Egidi (1975, p. 23) stated this result but did not demonstrate or discuss it.

simple comparison of "monopoly" prices and profit rates with the corresponding competitive or "natural" levels, it will be apparent that the conclusion is directly relevant to the comparison of "market" and "natural" levels of prices and profits. One cannot follow Smith, Ricardo, Marx (and others) in supposing that "high" and "low" market prices are invariably associated with "high" and "low" industry profit rates.

III Convergence of the Classical Competitive Process

If a "low" market price in a particular industry can be associated with a "high" profit rate in that industry, and if that "high" profit rate induces a capital inflow to and an output expansion in that industry, then it is clear that one cannot immediately assume that the "low" market price will tend to gravitate towards the corresponding natural price. And similarly for a "high" market price. The purpose of this section of the paper is to emphasize both the importance and the difficulty of providing a convincing account of the working of the classical competitive process, of showing that the natural price system does indeed act as a centre of gravitation for market prices and market rates of profit. It is important to state at once that our concern will be with the problem of providing a *modern* account of the competitive process, in which the classical concepts of natural and market prices feature prominently; what follows is most definitely not presented as an interpretation of the theory of any particular classical author. Thus it would be beside the point to say of any element of the following discussion that "This is not what Smith/Ricardo/Marx/ . . . really meant"—which is not, of course, to suggest that what follows is immune to all criticism!

We shall naturally consider the convergence of the competitive process within the context of the same type of economy as that discussed in the previous section—a closed economy, that is, in which n commodities are produced by single-product processes, in an annual cycle, using no fixed capital and no storage activities. It will be convenient, however, to suppose now that the real wage rate consists of an unalterable basket of commodities advanced to the workers, so that in this section the matrix A will include the real wages paid in each process, per unit of gross output. (Outputs will now be variable, of course, so that A must now be interpreted as a matrix of constant coefficients representing constant returns to scale processes.) If $\mathbf{p}_t$ is the price (row) vector ruling at the end of period t and $\mathbf{r}_t$ is the row vector of industry profit rates achieved in period t, then

$$\mathbf{p}_t \equiv \mathbf{p}_{t-1} A(I + \hat{\mathbf{r}}_t) \qquad \text{.....(8)}$$

and

$$\mathbf{p}^* \equiv \mathbf{p}^* A(I + r^*), \qquad \text{.....(9)}$$

where $\hat{\mathbf{r}}_t$ is the diagonal matrix formed from $\mathbf{r}_t$ and (9) defines the "natural" or "competitive" position. We now define $\mathbf{x}_t \equiv (\mathbf{p}_t - \mathbf{p}^*) \geqslant -\mathbf{p}^*$ and $\mathbf{y}_t \equiv (\mathbf{r}_t - r^*\mathbf{e})$, where $\mathbf{e}$ is a unit row vector. Simple manipulation of (8) and (9) leads to

$$\mathbf{x}_t \equiv \mathbf{x}_{t-1} B + \mathbf{y}_t K + (\mathbf{x}_{t-1} A\hat{\mathbf{y}}_t), \qquad \text{.....(10)}$$

where $B \equiv (1 + r^*)A$ and K is the diagonal matrix formed from $(\mathbf{p}^*A)$.

Relation (10) is just a definitional identity but we must now make some specific assumptions. It is most important to notice that we make these assumptions for the sole purpose of showing how even very simple "market price" relationships can quickly lead to highly complex stability questions. These assumptions are certainly *not* implied to be reasonable on grounds of realism. Since no storage is supposed to be possible, the market price of each commodity will be assumed to adjust to clear the market in each period. To a linear approximation, we may suppose that

$$\mathbf{p}_t = \mathbf{p}^* - (\mathbf{q}_t - \mathbf{q}^*)D \qquad \text{.....(11)}$$

where $\mathbf{q}_t$ is the row vector of gross outputs in period t, $\mathbf{q}^*$ is the row vector of Smithian "effectual demands", interpreted as *gross* output demands, and D is a square matrix with positive diagonal elements (and perhaps a dominant diagonal).

To a simple, linear approximation, we might also suppose that $(\mathbf{q}_t - \mathbf{q}^*)$ is determined by

$$(\mathbf{q}_t - \mathbf{q}^*) = h(\mathbf{q}_{t-1} - \mathbf{q}^*) + \mathbf{y}_{t-1}S \qquad \text{.....(12)}$$

where $0 \leqslant h \leqslant 1$ and S has a positive diagonal (and perhaps a dominant diagonal).[20] When $h = 0$, the deviation of actual output from effectual demand responds only to profit rate deviations for the previous period. (Recall that all capital is circulating capital and can be redirected in full at the end of each period.) When $h = 1$, it is the *change* in actual output which responds to the last period profit rate deviations; more generally, the larger is h, the slower is the adjustment of output to effectual demand, $\mathbf{q}^*$, for given S. (Relation (12) could readily be made more general, while still linear, via the addition of terms in $(\mathbf{q}_{t-2} - \mathbf{q}^*)$, etc. and $\mathbf{y}_{t-2}$, etc. but will serve as it stands.) From (11) and (12), we obtain

$$\mathbf{x}_t = h\,\mathbf{x}_{t-1} - \mathbf{y}_{t-1}(SD) \qquad \text{.....(13)}$$

It will be noted that, in line with the results of the previous section, neither (10) nor (13) ensures that $(\mathbf{x}_t\mathbf{y}_t')$ will be positive.

[20] Equation (12) relates output levels to the divergence of actual profit rates *from the natural rate*, through $\mathbf{y}_{t-1}$. Egidi (1975, p. 22–24) has suggested that capital movements (and hence outputs) should rather be related to the divergences of actual profit rates *from the (actual) average rate* and noted that this latter relation is more complex. To accept his argument on this point would not alter the general thrust of our argument.

Relations (10) and (13) form a very complex set of simultaneous difference equations, not least because of the final, non-linear term on the right-hand side of (10). It is probably not possible to obtain the explicit solution of such a system, or even to form an impression of its movement over time other than by repeated trial runs of particular numerical examples. However fascinating such simulations would be, it is far from clear that any *economically* useful qualitative conclusions could be drawn as to the likelihood that the system would converge to the natural price/natural profit rate/effectual demand configuration. This would, indeed, continue to be the case even if we were to ignore the non-linear term in (10), in order to obtain an analytically tractable, linear system. By supposing that matrix (*SI*) has a full set of distinct roots, and hence a set of linearly independent vectors which can be used as a basis, we could change to that basis and then, no doubt, derive certain conditions under which the linearized system would converge. Yet we should still have no economic grounds for stating that those conditions could or could not be expected to hold in all, or even most, plausible circumstances. And this despite the *very* simple assumptions underlying (10) and (13); those assumptions cannot, of course, be defended as being "realistic".

It is, of course, a general truth that the results of a stability analysis can be very sensitive, even in a qualitative sense, to the precise assumptions made and that equally plausible assumptions can lead to significantly different (lack of) convergence properties of a system.[21] To illustrate the point further, we may note first that in his analysis of a "Sraffian" system, Egidi (1975) produced a *stability* result, albeit in a strongly *local* sense and after making some very strong assumptions. And we may note second that Nikaido (1978), in his analysis of a "Marxian" system, considered three different adjustment models and concluded that "*non*equalization of profit rates is an almost universal phenomenon" (p. 37, emphasis added), given that "organic compositions of capital" differ between sectors. Medio (1978) also presents a generally sceptical account of the task of establishing the convergence of market price to natural price, raising the possibility of limit cycles, of non-uniqueness and the role of "returns to scale" in production. (Like Hosoda, 1984, however, he suggests that any responsiveness of consumer demand to relative prices will assist convergence.) Dumenil and Levy (1983), by contrast, emphasize the possibility of convergence in their analysis, which includes a role for inventories and inventory changes, even if it is not

[21] It may be noted that the convergence problem stated by (10) and (13) is not of the same nature as the most common kind of Walrasian stability question. In the latter, no real transactions take place between the successive iterations, whilst in our problem buying, production and selling do indeed occur between successive dates.

entirely clear why they do so, given their demonstration that the presence/absence of convergence will depend on the magnitudes of certain parameters. Finally, Franke (1983, 1984) argues, in part, that models for the analysis of convergence such as those used by Nikaido (1978); Benetti (1979) and that sketched above are still too simple, in that they underestimate the degree of interdependence between the different sets of relations (market clearing, adjustment of output, etc.); he also presents some criticism of Nikaido (1983). In his (1984) paper he reaches a decidedly negative conclusion concerning the likelihood of stability (p. 17). It is thus apparent that agreement on clear-cut results concerning the "gravitation" of market prices to natural prices is not imminent.

The moral of what has been said so far, in the present section, is *neither* that the classical competitive process converges towards the "natural" configuration—the "centres of gravitation"—*nor* that it fails to do so. The moral is simply that there is a genuine question at stake here, whose answer is not self-evident. Centres of gravitation, towards which the persistent and dominant forces at work are constantly tending to push the economy, are of significance only if they really do act as centres of gravitation; if the forces thought to be dominant really are so. And, it need hardly be said, it cannot be established that they "really do" and "really are" by assumption; "Simple labelling of forces as dominant is not enough" (Eatwell, 1982, p. 211). In other words, one must not follow the late C. E. Ferguson in relying on an act of faith, but must present a clear and coherent account of *how* and *why* market prices and profit rates are constantly attracted towards their natural levels.

In order to provide a convincing argument that the "natural" configuration does indeed act as a centre of gravitation, it would naturally be necessary to go far beyond the very simple kind of analysis sketched out above. It would be necessary, for example, to consider the roles of storage and of fixed capital, the latter making output adjustment more complex, particularly adjustment in a downward direction. Investment lags, of course, slow down upward variations of output, at least those requiring the installation of new capacity. More generally, one might doubt that investment and output changes would occur in a linear, or even in a *symmetric* way in response to profit rate deviations, contrary to our assumption in (12) above. And Egidi's suggestion that it is profit rate deviations from the average rate, rather than from the natural rate, which guide investment (noted above) should probably be accepted, making the analysis more complicated. Of course, it *might* be that profit rate deviations are reduced more rapidly than are price and output deviations, but a proper analysis of this possibility would require that the role of the money market and of the stock market be incorporated into one's

account of the competitive process.[22] This consideration reminds us, in turn, that the dispersion of knowledge, of beliefs, of experience and of expectations probably plays a central part in the workings of competition. Again, our simple analysis above proceeded on the assumption that market wages and natural wages always coincide; this is clearly an unacceptable assumption but far less clear is how easy it would be to incorporate a plausible account of labour markets and of labour (im-)mobility into our analysis. Nor is it yet fully understood how the competitive process is to be analysed in the (actually prevailing) conditions of choice of technique between joint products processes, since *each* of two joint production systems can be the cheaper when evaluated at its "own" prices.[23] Finally - though not exhaustively - a number of questions remain open concerning the concept of effectual demand. How are effectual demands to be defined in an *open* economy? How is a change in effectual demand for a Sraffa-basic commodity to be understood? How are effectual demands defined in a system which does not exhibit constant returns to scale?[24] And why need the set of natural prices and of effectual demands be unique in a non-constant returns to scale system?[25]

The questions raised in the previous paragraph should suffice to indicate that the provision of a satisfactory modern account of the competitive process, showing that the "natural" price and profit rate system constitutes a centre of gravitation for market prices and profit rates, may well prove to be a demanding task. Yet that provision must be made if the recent revival of interest in classical economics is to become the source of a powerful and successful method of economic analysis.

IV Conclusion

It has been shown that in their accounts of the competitive process, Smith, Ricardo and Marx each supposed that deviations of market prices from natural prices would always have the same signs as the corresponding deviations of market profit rates from the natural rate. It has been seen, however, that this supposition is generally invalid in an economy using produced means of production. This result was first demonstrated and explained in the context of an unchanging economy and then incorporated in the analysis of a dynamic, competitive process. It has been noted, in this latter context, that it appears to remain an open question whether the classical natural price and profit rate system does play the role of a centre of gravitation.

[22] H.-D. Kurz has impressed this point on me.

[23] As has been shown by N. Salvadori and, independently, by C. Bidard.

[24] C.f. Arena (1978, pp. 341–3).

[25] Effectual demands are quantities defined at natural prices—but natural prices depend on quantities if there are not constant returns.

References

Arena, R. (1978). "Note sulla concezione classica della concorrenza", *Economia e Lavoro*, 1978, No. 2, pp. 323-352. (French version, "Note sur la conception classique de la concurrence", *Cahiers d'Économie Politique*, No. 5, Paris, P.U.F., 1979.)

——— (1982). "Réflexions sur l'analyse sismondienne de la formation des prix", *Revue Économique*, Vol. 33, No. 1, pp. 132–149.

Benetti, C. (1979). *Smith. La teoria economica della società mercantile*, Milano, Etas Libri.

Bruno, M. (1969). "Fundamental Duality Relations in the Pure Theory of Capital and Growth", *Review of Economic Studies*, Vol. 36, No. 1, pp. 39-53.

Cahiers d'Économie Politique. (1981). Number 6, "La formation des prix: A. Smith, D. Ricardo, K. Marx" (by various authors), Paris, P.U.F.

Duménil, G. and Lévy, D. (1983). "La Concurrence Capitaliste: Un Processus Dynamique", OFCE and CEPREMAP, Paris, mimeo.

Eatwell, J. (1982). "Competition" in I. Bradley and M. Howard (eds.), *Classical and Marxian Political Economy*, London, Macmillan.

Egidi, M. (1975). "Stabilità ed Instabilità negli Schemi Sraffiani", *Economia Internazionale*, Vol. 28, Nos. 1–2, pp. 3–41.

Franke, R. (1983). "An Elementary Model of a Multi-Sectoral Classical Gravitation Process", Universität Bremen, mimeo.

——— (1984). "Modelling Gravitation Processes as Sequences of Temporary Equilibria", Universität Bremen, mimeo.

Hollander, S. (1973). *The Economics of Adam Smith*, London, Heinemann Educational Books.

Hosoda, E. (1984). "On the Classical Convergence Theorem", Manchester University, mimeo.

Marx, K. (1966). *Capital, Volume III*, Moscow, Progress Publishers.

——— and Engels, F. (1973). *Selected Works in Three Volumes*, Volume One, Moscow, Progress Publishers.

McNulty, P. J. (1967). "A Note on the History of Perfect Competition", *Journal of Political Economy*, Vol. 75, No. 4, pp. 395-9.

Medio, A. (1978). "A Mathematical Note on Equilibrium in Value and Distribution", *Economic Notes* (Monte dei Paschi di Siena), Vol. 7, Nos. 2–3, pp. 97–106.

Mill, J. S. (1891). *Principles of Political Economy*, London, Routledge and Sons.

Morishima, M. (1973). *Marx's Economics. A Dual Theory of Value and Growth*, Cambridge, Cambridge University Press.

Nikaido, H. (1978). "Refutation of the Dynamic Equalization of Profit Rates in Marx's Scheme of Reproduction", Department of Economics, University of Southern California, mimeo, MRG7722.

——— (1983). "Marx on Competition", *Zeitschrift für Nationalökonomie*, Vol. 43, No. 4, pp. 337–362.

Ricardo, D. (1951 *et seq.*). *The Works and Correspondence of David Ricardo*, Edited by Piero Sraffa with the collaboration of M. H. Dobb, Cambridge, Cambridge University Press.

Richardson, G. B. (1975). "Adam Smith on Competition and Increasing Returns" in A. S. Skinner and T. Wilson (eds.), *Essays on Adam Smith*, Oxford, Clarendon Press.

Smith, A. (1981). *An Inquiry into the Nature and Causes of the Wealth of Nations*, Indianapolis, Liberty Press.

Sraffa, P. (1960). *Production of Commodities by Means of Commodities*, Cambridge, Cambridge University Press.

Stigler, G. J. (1967). "Perfect Competition, Historically Contemplated" as reprinted in *Essays in the History of Economics*, Chicago and London, University of Chicago Press. (Originally in *Journal of Political Economy*, Vol. 65, No. 1, 1957.)

Studien zur Entwicklung der ökonomischen Theorie I. (1981). Berlin, Dunker and Humblot.

Targetti, F. (1978). *Valore e accumulazione*, Milano, Etas Libri.

[11]

A Reinterpretation of Classical Monetary Theory*

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I. Introduction

Relevance to current policy issues is usually not the motivation for studying the history of economic theory. However, questions about the practicality of conducting monetary policy in a deregulated financial system by controlling the monetary aggregates are stimulating interest in convertibility as an alternative to our present monetary arrangements [3; 6; 66]. Since classical writers were mainly concerned with monetary theory and policy under a gold standard, it is to be expected that renewed attention will be devoted to classical monetary theory.

My aim in this paper is to show that, contrary to received views about classical monetary theory, it was not based on the quantity theory of money. On the contrary, it was based on a theory of a convertible, competitively produced money supply that was fundamentally different from the quantity theory. Using the modern theory of a competitive money supply, we can now rigorously derive many of the basic propositions of classical monetary theory that have been denied or misunderstood by modern theorists operating within the framework of the quantity theory.

Received views about classical monetary theory can be summarized by the following propositions:

1. Classical monetary theory was based on the quantity theory [5, 145–76; 42, 143; 61, 59].
2. In classical theory the role of convertibility was to impose a limit on the reserves against which the banking system could create nominal balances. Under convertibility an excess supply of nominal balances that led to an increase in the price level would eventually be reversed by a loss of reserves and a consequent contraction of nominal balances [3, 13; 42, 153].
3. For convertibility to be effective, the banking system had to maintain a stable ratio between their reserves and the nominal balances they created. Since the banking

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