Part III

On Some Supposed Obstacles to the Tendency of Market Prices towards Natural Prices*

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I. INTRODUCTION

1. I had thought of taking the occasion of this conference to tidy up some reflections which had been stimulated many years ago by my reading of a first draft of Ian Steedman's "Natural Prices, Differential Profit Rates and the Classical Competitive Process", which was to be published some years later in the *Manchester School*. However the time to prepare the paper I had intended for this conference has not been available, and here I am with some notes only a little more developed than they were in 1982 and 1983 and without the readings I had hoped to do in the meantime. Since I have managed to convince myself that the argument holds in its essential lines, I have come to submit it for discussion.

In his article (Steedman, 1984), Steedman argues that Smith, Ricardo and Marx "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" (*op. cit.*, p. 123). He then asks:

> Could it not happen, ... 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 price, with the result that that industry has a profit rate below the natural rate? (*ibid.*)

This question, to which Steedman devotes the first part of his paper, has of course an affirmative answer. Nothing prevents the compound commodity consisting of the means of production — among which we may for a moment include the real wages paid in advance at the given rate — from having a market price exceeding its natural price in a proportion larger than the output does, in which case the rate of profits will have to be below the natural rate.

Indeed, as far as can be seen from Steedman's own references, neither Adam Smith, nor Ricardo nor Marx stated that a market price higher than the natural price is necessarily associated with a rate of profits higher than the natural rate. This would have been wrong, even independently of the problem raised by the means of production, because an opposite sign of the deviations of market price and profit rate would obtain if the rates of wages and rents alone sufficiently exceeded their natural levels.[1] The classical authors appear rather to have confined themselves to the less restrictive statement that it is by raising the market price sufficiently high, relative to wages, rents, and the means of production, that the rate of profits of the industry whose output must be increased is elevated above that obtaining in other industries.[2] Indeed, as we shall see, the very notion of an excess of the market price over the natural price has an arbitrary element attached to it because it depends on the choice of the numeraire (par. 8 below).

2. However, let us leave aside the history of thought and return to analysis. More important than the possibility of a high market price going together with a low rate of profits, is the question which Steedman raises in the second part of his paper: namely, whether such a possibility might not prevent the ultimate tendency of the market price towards the natural price, by causing the output of the commodity to decrease, thus sending the market price even higher.[3] It will be argued here that that question can be answered negatively and that the deviation of the market prices of the means of production from the respective natural prices will not prevent the gravitation of market prices towards natural prices.

The reason for this result can perhaps be preliminarily described in an intuitive way by noting that when e.g. for a commodity A_1 a negative deviation of the market price accompanies a positive deviation of the profit

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[1] I. Steedman describes Adam Smith as stating that when "the market price is e.g. below the natural price, then the wage and/or the profit rate and/or the rent paid in the industry must fall below their natural rates» (1984, p. 124, our emphasis). Steedman agrees here that Smith leaves open the possibility e.g. of a market price below the natural price, while the profit rate is above the natural level, but he argues that Smith's analysis ignored the means of production and therefore the question Steedman is addressing (STEEDMAN, 1984, p. 125). In this connection it should however be remembered that Smith thought that the value of the means of production could be reduced to wages, profit and rents (SMITH, 1910, ch. VI, pp. 44-5). Therefore when he refers to wages, profits, and rents, he should be interpreted as referring to those accruing in the indirect, as well as in the direct, production of the commodity in question and thus, in fact, to the value of the means of production.

[2] See e.g.: "It is only in consequence of variations [of market prices] that capital is apportioned precisely ... to the production of the different commodities. With the rise or fall of price, profits are elevated above, or depressed below their general level" (RICARDO, 1951, p. 88, our emphasis).

[3] Cf. e.g.: "If a 'low' market price in a particular industry can be associated with a 'high' profit rate [...] then it is clear that one cannot immediately assume that the 'low' market price will tend to gravitate towards the corresponding natural price" (STEEDMAN 1984, p. 134: see similar passages at pp. 123-4, 127).

rate, then the same opposition of signs cannot be true for at least one of the direct or indirect means of production of A_1: that having the minimum ratio of market to natural price.[4] For that means of production the profit rate deviation will have to be negative like that of the relative market price, and the associated fall of output will tend to raise its market price, leading either directly, or in a finite number of stages, to a fall in the rate of profits of A_1, and thus to a reversal in the initial 'perverse' rise in output.

3. Our formal argument in this paper will be founded on three assumptions. The first will concern a fall in the output of the industry or industries showing the minimum rate of profits in the economy. The second will concern conditions under which that fall in output will result in a rise of the profit rate of the industry in question. We shall claim that the generality of those two assumptions is hardly disputable. The third assumption will instead be more restrictive in that it will concern a *monotonic* rise of the minimum profit rate, rather than that *eventual* rise of the rate which it will be possible to demonstrate on the basis of the first two assumptions. It will then be possible to show that as that rise reaches the natural rate, the natural position of the economy will have been achieved. The consequences of abandoning the restrictions underlying the third assumption will then be discussed at the end of the paper.

The layout of the paper will be as follows. In the next Section we shall introduce the postulate of given (normal) effectual demand, a basic premise of the classical treatment of market prices. There, we shall also set out our definitions and assumptions about the kind of economy we shall be concerned with. In Section III we shall come to the rise of the mininum rate of profits in the economy and to the three assumptions mentioned above. Section IV will then be devoted to proving some propositions needed in order to draw the implications of that rise. In Section V those propositions will be used to show how, when che minimum rate of profits in its rise reaches the natural rate r^*, convergence to the natural position of the economy will have been achieved, whatever may have been the initial deviations of the market prices of the means of production from their natural levels. In Section VI we shall conclude the article by discussing the generality of our conclusions and the method of argument used in the paper. We shall there claim that, though our primary aim has been to examine and reject the idea that deviations of market from natural prices of the means of production may prevent a tendency to the natural position, yet our argument may allow for some more general affirmative conclusions.

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[4] See Proposition I, par. 19 below. Assuming, as Steedman assumes in the relevant part of (1984), that all commodities are basic, each commodity must enter the production of A_1 directly or indirectly and this will therefore have to be true also for the commodity having the minimum ratio of market to natural price in the economy.

4. In the course of our argument we shall follow in the footsteps of Adam Smith and the old classical economists and take as given, and therefore as constant during the process of adjustment, the normal effectual demand of each commodity — the quantity, that is, of each commodity which would be demanded when the prices and outputs of all commodities are at their normal levels.[1] It should be immediately noted that this classical postulate does not imply any assumption of stationarity of the economy. It only rests on the view that the forces of competition, which may bring the market prices towards the natural prices, will be acting in a way which is broadly independent of what the normal outputs (effectual demands) happen to be or of how they happen to evolve over time. It follows that market prices are best studied *separately* from the circumstances determining the normal quantities produced and the latter may be taken as given when studying the former.

This classical postulate of given effectual demands needs to be stressed because it seems to have been frequently overlooked in recent literature, at the expense of the generality and validity of the results, as we shall argue later in the paper.[2]

5. Though the subject is beyond the aim of the present paper some observations may here be necessary with respect to the assumption, implied in the above postulate, that the *aggregate* economic activity (on which the effectual demands of the individual commodities evidently depend) can be taken as given in analysing market prices. A first view which may be taken in that respect is that the deviations of the actual outputs from the respective effectual demands (and therefore their changes during the process of adjustment) will in general broadly compensate each other with respect to their effect on aggregate demand and its determinants (the saving propensities and the level of gross investment). This will allow taking as given (constant) the aggregate level of activity and the normal effectual demands based on them.

This view about a compensation of the effects on aggregate demand of the output deviations of individual commodities appears to be acceptable so far as it goes. However, the classical postulate of given effectual demands does not appear to necessarily rest on it. Also here what need in effect be assumed is only the possibility of *separating* the two analyses. Thus, if

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[1] Cf. SMITH, 1776, vol. I, p. 73. Our definition of the effectual demand of a commodity modifies that of Adam Smith by specifying it also in relation to the natural prices of the other commodities and to the normal outputs of all commodities. The reason of this modification, and for further qualifying the effectual demands referred to in the text as 'normal', will be seen in pars. 10-11 below.

[2] Cf. *e.g.* the argument in NIKAIDO, 1985, which we shall consider in par. 27 below.

we had reasons to think that the effects on aggregate demand of the circumstances causing, or arising out of, certain kinds of deviations of actual from normal relative outputs, were sufficiently important — then, it would seem, those effects could be considered in the separate analysis of the determinants of aggregate economic activity and of the effectual demands of the several commodities.[3,4]

In the present paper, the level of aggregate demand assumed constant in the course of the process of adjustment, will be measured by the level of aggregate labour employment.

6. We may now proceed to the assumptions defining the economy we will be envisaging. We assume n commodities $A_1 \ldots A_n$, obtained, as in Steedman's paper, from single product industries in a yearly production cycle with wages advanced at the beginning of the year. Only one method of production will be available in each industry. All the n commodities will be 'basic products',[5] and, besides, labour will be assumed to enter all of them, directly or indirectly.

We shall also assume at first that the real wage is at its natural level and, in accordance with the premises of the classical economists, we shall take it to be given (separately determined). Our numeraire will be the composite wage commodity G, consisting of the g wage goods taken in the proportions in which they enter the natural wage rate. A quantity w^* of G will accordingly constitute the natural wage. We shall indicate the wage goods by

$$A_1, \ldots, A_g; \qquad \text{for } g \leqslant n$$

and call

$$g_1, g_2, \ldots, g_g$$

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[3] E.g. if a technical change were to cause a drastic fall in the effectual demand for the product of industries which were previously of great quantitative importance in the economy, it is easily conceivable that, in certain circumstances at least, this may result in a lowering of the long-period level of aggregate activity in the economy. Now, the depressive effects of those initial deviations from effectual demands could be taken care of in separately determining new levels of aggregate demand. The forces which will drive the individual outputs towards the respective, new levels of effectual demand will remain the same which can be analyzed on the assumption of given effectual demands. (A case in point appears to be Marx's analysis of how disproportions between industries might result in a fall of aggregate demand. Cf. MARX, 1956, section 3; discussed in DOBB, 1937, pp. 118-21).

[4] In contrast with this, it is often held that the tendency towards a normal position of the economy requires the 'path independence' of that position and, therefore, that the process by which actual prices and outputs may adjust towards that central position should not affect the data of the latter (in particular the normal prices and outputs). It is however not always made clear why the special cases in which 'path dependence' were to appear important, could not be dealt with by means of the appropriate changes in data — as we have just claimed to be possible in special cases of 'path dependence' of aggregate demand (see the preceding footnote).

[5] SRAFFA, 1960, p. 8.

the quantities in which these goods appear in the physical unit of the wage commodity G. The natural wage w^* is positive and less than the maximum wage W for wich the profit rate is zero. The usual equations

$$p_1 = (a_{01}w^* + a_{11}p_1 + \ldots + a_{n1}p_n)(1 + r^*)$$
$$\ldots\ldots\ldots\ldots\ldots$$
$$\ldots\ldots\ldots\ldots\ldots \quad [1]$$
$$p_n = (a_{0n}w^* + a_{1n}p_1 + \ldots + a_{nn}p_n)(1 + r^*)$$

will then determine the natural profit rate r^* and the corresponding series of natural prices $p_1 \ldots p_n$, expressed in terms of the wage commodity, so that

$$1 = g_1 p_1 + g_2 p_2 + \ldots + g_g p_g \quad [2]$$

The market rates of profits r_1, r_2, ..., r_n obtainable in each industry in the given 'market position' — as we may call any position of the economy other than the 'normal' position — will, on the other hand, be given by the following equations, where by m_1, m_2, ..., m_n we shall indicate the market prices of the n commodities:[6]

$$r_1 = \frac{m_1 - (a_{01}w^* + a_{11}m_1 + \ldots + a_{n1}m_n)}{a_{01}w + a_{11}m_1 + \ldots + a_{n1}m_n}$$
$$\ldots$$
$$\ldots \quad [3]$$
$$\ldots$$
$$r_n = \frac{m_n - (a_{0n}w^* + a_{1n}m_1 + \ldots + a_{nn}m_n}{a_{0n}w + a_{1n}m_1 + \ldots + a_{nn}m_n}$$

obtained from

$$m_1 = (1 + r_1)(a_{01}w^* + a_{11}m_1 + \ldots + a_{n1}m_n)$$
$$\ldots$$
$$\ldots \quad [4]$$
$$m_n = (1 + r_n)(a_{0n}w^* + a_{1n}m_1 + \ldots + a_{nn}p_n)$$

and

$$1 = g_1 m_1 + g_2 m_2 + \ldots + g_g m_g \quad [5]$$

where, in accordance with the assumption indicated above, the market real wage has been assumed to be equal to the natural real wage w^*.

[6] Since the economy is not in its normal position, frictions of several kinds render free competition compatible with different *actual* prices being paid for the same commodity in different transaction occurring at the same instant of time. We shall however assume, as is generally done, that these different prices can be adequately represented at any given instant of time by a single "market" price .

7. We may note that in equations [3] and [4] we have expressed both the inputs and the output of each industry at the same market prices, though the inputs are bought at the beginning, and the outputs are sold at the end, of the production cycle. To this it might be objected that, to the extent in which they can be foreseen by the entrepreneurs with sufficient exactness, the changes in relative prices between the beginning and the end of the production cycle would affect what has to be reckoned as the market profit rate which influences the investment and the changes of output in the industry. In fact the appreciation (depreciation) of the product relative to the means of production *during* the year (be it the 'year' of the production cycle, or the period to which the flows refer in the case of continuous production[7]) consitutes a non-accidental element which entrepreneurs would take into account when comparing the prospective rates of profits between different industries.

It does not however seem that a consideration of the price changes over the production cycle (or over the reference period of the flows) is necessary at the present stage of the argument. The requirement of the correct foresight necessary to make those price-changes relevant will not generally be fulfilled. And economic theory, which cannot be expected to determine actual prices, but only prices corresponding to averages of actual prices, can hardly be expected to determine the actual changes in actual prices as distinct from providing a guidance to the *sign* of those changes.[8] Appreciation or depreciation of the capital stocks of each industry relative to its product seem accordingly to be best abstracted from in a first approsimation — just as we abstract from, say, the non-unicity of the market price in any actual situation of the economy.[9] Corrections can always be made to the conclusions thus reached, when the price changes are likely to be large and foreseen by the entrepreneurs.[10]

8. Equations [2] and [5] focus attention on the fact that the problem of the deviation of market from natural prices is a question of the deviation of *relative* market prices from *relative* natural prices. An implication of this relative nature of the deviation of market from natural prices should be noted. By definition, market and natural price must coincide for the commodity which we use as our standard of value — and which, for the sake of clarity, we may for a moment suppose to be a single commodity, call it A_1. This coincidence does of course not imply that output and

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[7] For the notion of continuous production cf. *e.g.* Garegnani, 1990, pp. 25-26.

[8] As Marshall recognized, "dynamical solutions, in the physical sense of economic problems, are unattainable" (MARSHALL, 1898, pp. 38-39).

[9] See n. 6 above.

[10] E.g. we might note how forecasts that the relative market price of a commodity in the production of which a low rate of profits can be obtained will rise over time and viceversa, would decrease somewhat the divergence between the market profit rates with respect to what that divergence would be if prices remained constant.

effectual demand need coincide for A_1 any more than for any other commodity. For A_1 , as for A_2, A_3, etc., an excess, say, of output over effectual demand will imply a relative market price which is below the relative natural price. Thus if, for example, all the other commodities happened to exchange among themselves according to their natural prices, the market prices of those commodities would all have to be uniformly higher than their natural prices, as an expression of the excess of output over effectual demand of A_1 (as well as of the corresponding shortage of the output of those commodities relative to the respective effectual demands).[11] This is evident when, as just assumed, the standard of value consists of a single commodity A_1, but the same element will be present when we refer to any composite commodity, like our commodity G above.

III. THE RISE OF THE MINIMUM PROFIT RATE

9. Let us then begin by considering a commodity A_h, in the production of which the rate of profits is the minimum among the market rates of profits r_1, r_2, ..., r_n resulting from equations [3].[1] Competition will ensure that capital will flow out of the industry A_h, and its output O_h will decrease, possibly after a time lag.[2] We may accordingly write

$$\frac{dO_h}{dt} < 0 \quad \text{if} \quad r_h \leq r_i \quad (i = 1, \ ..., \ n),$$
[6]

with the strict inequality holding for at least one couple h, i.

This eventual decrease in the output of the industry (or industries) showing the minimum among the rates of profits in the economy, is the first of the two basic assumptions on which our argument will be based (par. 3 above).

The effect of that decrease in output in raising the market price of A_h, relative to that of its means of production and to the wage costs — and therefore its effect in raising the rate of profits (see equations [3]) — cannot however be taken for granted. We shall see, in pars. 16-17 below, that the input-output relations and the corresponding interactions between the market price of commodity A_h, and those of the means of production and wage goods used in its production, will constitute no obstacle to the rise of r_h. The obstacles to such a rise which we must consider now are instead

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[11] See the assumption of constant aggregate demand made in par. 5 above.

[1] In case more than one industry happened to have that same minimum level, what we shall say should be referred to that *group* of industries, in the form which we shall see in section V, below.

[2] Cf. par. 29 below for the implications of the lag between production decisions and realized outputs. Cf. also below n. 6 in this Section for a discussion of what would have to be understood by changes in the output O_i, when we abandoned the assumption that all capital is circulating capital, and accordingly introduced the distinction between outputs changing merely because of a change in the degree of utilisation of productive capacity, and outputs which change together with a corresponding change in the level of capacity.

those which may conceivably affect the demand for A_h because of the fall of O_h, and because of any adjustments occurring in the outputs and prices of the other industries, about which nothing will be postulated in our argument. In fact, if those changes were to lower in some sense the 'demand' for A_h more rapidly than O_h is lowered, then clearly we could not expect a rise of r_h.

In order to deal with such changes in 'demand' we have however to introduce first the concept of a 'market' effectual demand, as distinct from that of the 'normal' effectual demand referred to so far.

10. By 'market' effectual demand D_i^m for commodity A_i ($i = 1, 2, ...,$ n) we shall mean the quantity of A_i which would be demanded for use[3] in the current 'market' position of the economy, but at a price m_i^* of A_i which, unlike m_i, would yield the natural rate of profits r^* on the costs for wages and means of production estimated at their current market levels. The price m_i^* is therefore given by the equation

$$m_i^* = (1 + r^*)\,(a_{0i}w^* + a_{1i}m_1 + ... a_{ii}m_i^* + ... + a_{ni}m_n). \qquad [7]$$

Except, that is, for the price m_i^*, which we may for brevity call the 'reference price' of A_i in the given market position of the economy, the 'market' effectual demand for A_i will be referred to the actual prices and outputs of that position.[4]

The price m_i^* is thus neither the market price m_i nor the natural price p_i. It is needed in order to define the market effectual demand, which is in turn intended to provide a common quantitative expression for the effects on the market of A_h of the adjustments in outputs and prices occurring in the economy. It will exceed, or falls short of, the corresponding market price m_i according as r_i exceeds, or falls short of, r^*. The price m_i^* will on the other hand exceed, or fall short of, the natural price p_i because of the deviation of the market prices of the wage goods and means of production from the corresponding natural prices.

The 'market' effectual demand will thus differ from the 'normal' or 'natural' effectual demand, not only because the price m_i^* differs from the natural price p_i, but also, and above all, because of the deviations from the respective normal levels of all actual outputs, and of the market prices

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[3] We exclude, that is, from market effectual demand any quantity demanded for changes in inventories. Here, as in the case of 'normal' effectual demand, it seems in fact that we should exclude those quantities which are demanded because current prices are thought to differ from their long-run normal. This is so because these concepts of 'effectual demand' are meant to analyse the primary phenomena which cause the price of the commodity to be above or below any such a long-run normal.

[4] The present concept is close to that of 'actual' effectual demand put forward in CICCONE (1990, pp. 4-5). Though intended to take into account the effects of accidental circumstances on demand, that concept is however still defined for a price of the commodity equal to the natural price.

of the remaining commodities. The 'market' effectual demand for A_i will in fact depend on the level of those market magnitudes to the extent to which A_i is required as an input for those commodities, or has relations of complementarity or supplementarity in consumption with them or, also, to the extent in which those magnitudes affect the distribution of individual incomes and the part of them spent on A_i.

11. The usefulness of this concept of 'market' effectual demand lies in the fact that the current behaviour of market prices will depend on the 'proportion'[5] which the current output bears to that 'market' effectual demand, rather than on the proportion it bears to the 'normal' effectual demand.[6] The consideration of the latter proportion as governing the current behaviour of market prices and rates of profits, such as we find it in Adam Smith and the other classical authors, appears in fact to have been implicitly founded on the idea that the effects on the demand for A_i of the deviations of the actual outputs and of the prices of the other commodities from their normal levels will tend to compensate each other. That compensation may perhaps be assumed, until convincing cases have been pointed out to the contrary, with respect to the effects on the demand for A_i which the deviations from normal levels in the other markets may have through distribution. That compensation seems however more difficult to assume with respect to the effects on the demand for the commodity as an input, and also, conceivably, on its demand as a complement or a substitute of other commodities in consumption. These effects might in principle be

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[5] For the characteristic classical concept of 'proportion' between demand and supply cf. GAREGNANI, 1987, p. 565.

[6] In mainstream analysis we are used to deduce the sign of the price change of A_i by comparing the quantity of the commodity produced at the current price with the quantity of it demanded at that same price, and not with the quantity demanded at the different 'natural' price, as is done by Adam Smith and the classical economists. However, when, as in the classical economists, the question is that of the adjustment of the price to its long-period normal level — then, in mainstream theory no less than in classical theory, the direction of the change of the price can be said to be governed by the comparison between the current output and the quantity demanded at the normal price. In fact when quantity demanded and supplied are defined in the mainstream, temporary equilibrium sense (allowing, for example, for changes in inventories), they can be supposed to be approximately equal and therefore neutral with respect to the direction of change of the price. That direction of change will instead depend on the direction of change of the output, and therefore on a comparison of the current price with the normal (long-period) price and, ultimately, of the current output with the quantity demanded at the normal price. The nature of this process explains thus the apparent contradiction between e.g. the classical fall in price while effectual demand still exceeds supply, and the contemporary idea that the price rises so long as demand exceeds supply (and the opposite when supply exceeds effectual demand as in the case of commodity A_b). The above argument is illustrated in Fig. A below referring to the process as would be depicted in contemporary theory. As e.g. the demand has unexpectedly risen from dd to $d'd'$, the price initially rises from its long-period equilibrium level of p^* to the short-period equilibrium level p' (corresponding here to the classical market price) along the short-period supply curve resulting from the summation of the marginal cost curves corresponding to the existing plants and enterprises (the similar summations of the variable,

appreciable enough to raise questions for the tendency of actual prices and outputs to their normal levels, and must accordingly be examined.

12. It would thus seem that the same reasons for which Adam Smith would generally assume that when the quantity produced O_i of a

and total, average costs curves are also shown). However as plants and the number of enterprises increase because of the demand shift, the short-period supply curve will shift to the right and the short-period equilibrium price will progressively fall to p'' etc.. (with the output progressively rising) to finally reach p^* again, when plant and the number of enterprises have fully adjusted to the new level of demand. The opposite process of a fall in price from p^* to p_1, followed by a rise to p_2 etc. up to p^*, is depicted for the case in which we had an opposite unexpected shift in demand to the left from $d'd'$ to dd.
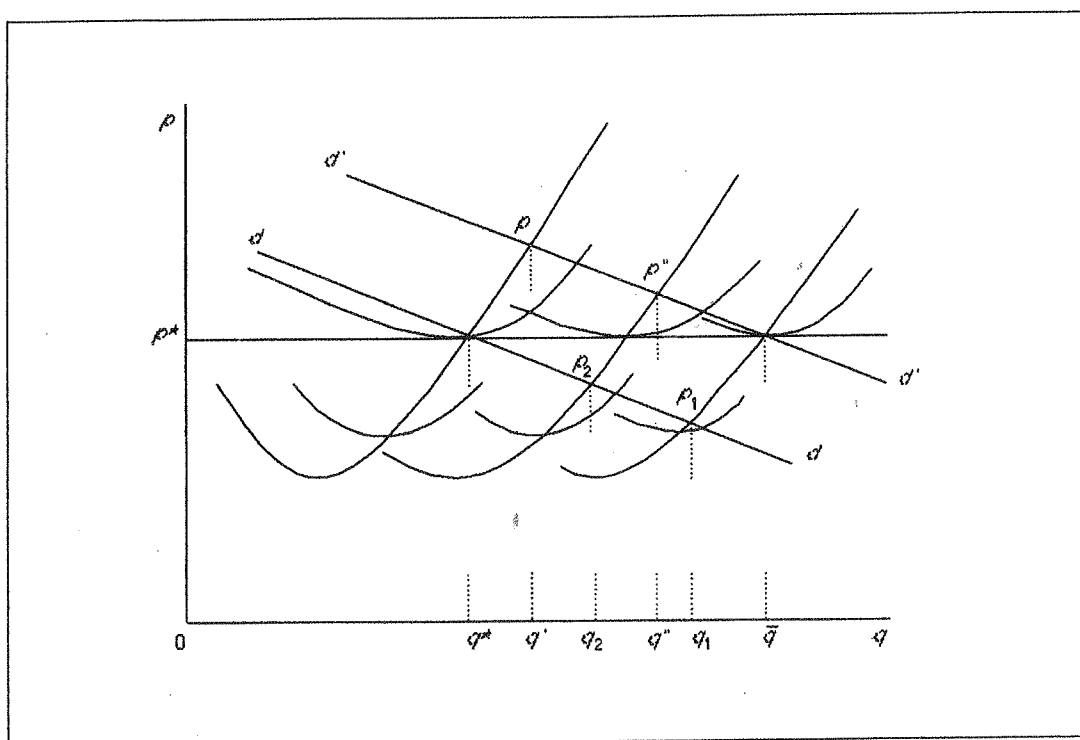
Fig. A

Thus in contemporary theory, no less than in classical theory, the direction of change of the price in the course of long-period adjustments, can be seen to be determined by a comparison between the current output and the quantity demanded at the normal price, the sign of the price change being negative (and not positive) when that demand exceeds the supply and vice versa. The difference between the two schools lies in that in classical theory no reversible demand and supply functions are used to trace the absolute size of the rise of the price, or of its later fall towards the normal price as output increases. For their argument founded purely on the *sign* of the price and output changes, the classical economists appear to need only the assumption that, in the generality of cases, a larger output requires a lower price to be absorbed. This assumption is less restrictive than that of a demand function since it requires neither a cardinally defined (as distinct from an ordinally defined) relationship between the price and the quantity absorbed by the market, nor a reversibility in such relationship.

commodity A_i fell short of the *normal* effectual demand, m_i would exceed the natural price, and vice versa (SMITH, 1910, ch. VII, pp. 49-52), can now lead us to assume that when O_i falls short of (exceeds) the *market* effectual demand D_i^m, then m_i will exceed (fall short of) m_i^*.[7] This makes it natural to go on to assume (as Adam Smith stated with respect to the proportion between output and normal effectual demand)[8] that the ratio m_i/m_i^* will increase as the ratio O_i/D_i^m decreases and vice versa. This assumption for which

$$\text{if } O_i \gtreqqless D_i^m, \qquad \text{then } m_t \lesseqqgtr m_i^* \qquad (i = 1, 2, ..., n),$$

$$\text{and } \quad \frac{d\,(m_i/m_i^*)}{dt} \gtreqqless 0 \quad \text{according as} \quad \frac{d\,(O_i/D_i^m)}{dt} \lesseqqgtr 0$$

[8]

will constitute the second basic assumption of our argument (par. 3 above)[9] — an assumption the generality of which would not seem to fall short of the corresponding one in the classical economists.

13. Equation [7] and assumption [8] entail not only that $r_i \lesseqqgtr r^*$ as $O_i \gtreqqless D_i^m$, but also, and most importantly, that r_i rises as O_i/D_i^m falls. The problem we left at the end of par. 9, about the effect of the fall of the output O_h of commodity A_h on the minimum rate of profits r_h, then becomes the problem of the effect of the fall in O_h on the ratio O_h/D_h^m.

The difficulty is of course that as O_h changes, D_h^m may also change, as a result, partly, of the change of O_h (for example to the extent in which A_h is used as an input for itself) and, partly, of what may be happening in the rest of the economy, about which, as we said, nothing is assumed in our argument. We can however analyse the circumstances on which the market effectual demand D_h^m depends, and attempt to reach some general conclusions about the sign of the changes which O_h/D_h^m will undergo because of the output and price changes mentioned above.

Thus, the main cause of the changes in D_h^m are likely to be changes in the outputs of commodities of which A_h is an input.[10] Particularly because

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[7] It may be noted that even when A_i happened to be the numeraire, and therefore $m_i \equiv 1$, m_i^* will not generally be unity. Also in that case therefore m_i/m_i^* can change as O_i/D_i^m changes.

[8] Smith writes: 'The market price will rise more or less above the natural price according as... the greatness of the deficiency [of the quantity brought to market]... happpen/s/ to animate more or less the eagerness of the competition', and a similar passage can be found to explain how 'the market price will sink more or less below the natural price' (SMITH, 1910, p. 50).

[9] As we shall see in par. 14, this second basic assumption should be interpreted as referring to quantities *supplied* inclusive, that is, of any (algebraic) accumulation of inventories of the commodity, rather than to outputs only. The presentation chosen here has been preferred for reasons of exposition and is justified by the assumption about inventories which we shall discuss in par. 14 and which will then be included in our third general assumption of par. 15.

[10] Only changes in the outputs for which the commodity A_h is a *direct* input need be considered, since the case in which A_h is an indirect input for a third commodity, will be taken care of by the changes in the output of the commodity A_j, which is an input of that third commodity, and for which A_h is a *direct* input.

of these changes we cannot exclude the possibility that, in some circumstances, as O_h falls, the market effectual demand D_h^m might fall even faster, leading to the result of a rise, and not a fall, in the ratio O_h/D_h^m; and therefore (by our second basic assumption above) to a further fall in the minimum rate r_h.[11]

However, it seems safe to assume that the market effectual demand for any basic commodity (as we have here assumed all the n commodities to be) has a positive minimum, below which it cannot fall for any length of time. Indeed no commodity whatsoever could continue to be produced (to be produced, that is, while replacing its means of production), without giving rise directly or indirectly to a positive effectual demand for each of the basic commodities. Now, each of the n commodities in the economy will require different quantities of A_h per worker for its integrated production.[12] A minimum market effectual demand for A_h may accordingly be assumed to exist in the given economy, which can be no smaller than the amount of it which would be demanded if the *net* product of the economy (the size of which remains constant in terms of the total labour employed: above par. 5) consisted only of the commodity requiring the minimum such amount of A_h. The market effectual demand for A_h could not indeed fall below that minimum for any length of time, unless the economy were on the way to its extinction. The same minimum level of D_h^m will evidently be there when the fall of that variable were to be the result of adjustments causing distributive changes or changes in prices and outputs for commodities which are complements or supplements of A_h.

It seems therefore possible to conclude that as O_h falls and approaches that minimum level of D_h^m, then, if not before, it will not be possible for D_h^m to fall faster than O_h and O_h/D_h^m will have to rise together with r_h.[13]

14. Our conclusion as to the fall of O_h/D_h^m when r_h is the minimum profit rate, concerns an *eventual* fall of that ratio and rise of r_h. We shall presently simplify our argument by provisionally assuming that O_h/D_h falls (r_h rises), not only eventually, but whenever the condition that r_h is the minimum rate of profits is verified — thus in fact assuming a monotonic rise in the minimum profit rate in the economy (our third and last assumption:

[11] *E.g.*, if A_h is used directly for the production of itself, an element of D_h^m will be proportional to the O_h of the subsequent year, and will therefore fall faster than O_h, if O_h falls at an increasing speed. It is then possible that O_h/D_h^m will rise as O_h falls.

[12] For this notion of integrated production cf. Sraffa's concept of a sub-system producing a net physical quantity of the specified commodity (SRAFFA, 1960, p. 90).

[13] For O_h/D_h^m to fall sufficiently there will be no need that O_h should fall below the minimum level indicated in the text. By assumption, O_h/D_h^m is initially higher than unity and it must remain so, so long as the minimum rate r_h remains below the natural level r^*. When on the other hand, O_h/D_h^m has become unity, thus indicating that the minimum rate r_h has become equal to r^*, the natural position of the economy will have been achieved (as we shall see in par. 19 below) and market effectual demand will coincide with normal effectual demand.

par. 3 above). In order to come to that assumption it is however necessary to consider first a complication which, were it not for the sake of a simpler exposition, we would have introduced before. In fact, our second basic assumption [8] should, strictly speaking, be taken to have been formulated in terms of the quantity supplied S_i of the commodity A_i, and not directly in terms of its output O_i; the difference $(O_i - S_i)$ being given by the algebraic accumulation of inventories of A_i. Indeed, a sufficiently large running down of inventories could make the supply exceed the output sufficiently to render the condition $O_i < D_i^m$ compatible with $m_i < m_i^*$, and also make a fall of O_i/D_i^m compatible with a fall of r_i.

However, it should be evident that any effect of the decumulation of inventories in making S_h/D_h^m rise, and the minimum rate r_h fall, in spite of the fall of O_h/D_h^m, could only be temporary. Any such running down of inventories could not proceed indefinitely, because the inventories would evidently be limited. Above all by lowering the price of the commodity, any such liquidation of inventories would enhance the fall in the output O_h which in the end is bound to dominate the behaviour of the ratio S_h/D_h^m, and therefore the behaviour of r_h. The same applies in the opposite case, of an accumulation of inventories of A_i, which were to prevent a fall of r_i despite the rise of O_i/D_i^m. Such an accumulation could only proceed for a limited time (the costs of carrying such inventories would see to this) and it would enhance the rise of O_i/D_i^m and, therefore, the eventual rise of S_i/D_i^m.

Now, this temporary character of the effects of the running up or down of inventories is in evident contrast with the fact that any tendency to the natural position of the economy cannot but be a long-period tendency, implying as it does changes in the size of plant and in the number of enterprises in the industry. And, with respect to any such long-period tendencies, running up or down of inventories are likely to be mere episodes. This observation is strengthened by the consideration that a liquidation of inventories, which could make the minimum rate of profits r_h fall further, is made unlikely or, in any case, likely to be very short lived, by the fact that it would occur for a commodity the value of which, relative to that of the mass of the other commodities, can be expected to rise in the longer run. We shall however return to the question in Section VI below (par. 29), when discussing the implications of the abandonement of the assumption about the monotonic rise of r_h to which we must now proceed, and by which we shall provisionally rule out the above possible influence of inventories (thus making it unnecessary to change the form in which we wrote condition [8]).

15. The conclusions of par. 13 above on the temporary nature of any rise of O_h/D_h^m and those just reached in par. 14 about the similar nature of any liquidation of inventories, preventing the rise of m_h/m_h^* despite the

fall of O_h/D_h^m, allow us now to simplify the exposition by adding the third assumption mentioned above. This third, provisional, assumption is that the rise of the minimum rate of profits will be verified whenever the rate of profits in question is the minimum, so that the eventual rise of the minimum rate which we demonstrated at par. 13, becomes a monotonic rise, irrespective of the commodity or commodities in the production of which that minimum rate can be obtained.[14]

We may now see that this third provisional assumption entails a fall of O_i fast enough to overcome any effect of a fall of D_h^m in raising the ratio O_h/D_h^m.[15] Moreover, it allows us to concentrate attention on long-run trends by excluding the possibility that a liquidation of inventories of the commodity might lower r_h despite the fall of O_h/D_h^m. As already mentioned, the consequence of dropping this third assumption will be discussed in section VI, par. 20 below.

16. What we must now consider is how the rise of r_h may in fact occur, without meeting any obstacles in the necessary relations between profit rates and prices which are established by the existing methods of production. The rise of the market rate of profits r_h will, as we said, require a rise of m_h, relative either to the market prices of the means of production proper, or to wages, or to both.

(i)   A rise in the rate of profits r_h through a rise in the price m_h relative to the prices of the means of production of course requires that the production of A_h should use means of production other than A_h itself, and this will always be the case. This is so because A_h is not the only commodity in the economy (no problem of deviations of market from natural prices would otherwise arise) and because, all commodities being basic (par. 5 above), at least one other commodity must appear among the means of production of A_h.[16]

(ii) A rise of r_h through a rise of m_h relative to wage costs is also always possible, except when A_h happens to be either the only wage good,

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[14] A less restrictive assumption would in fact seem sufficient for our argument in this paper: it is that should the minimum rate of profits of the economy ever (temporarily) fall, each minimum level then reached would lie above the previous one. Since in either form the assumption would have been dropped at the end of the paper, the form given in the text has been preferred because it allows for a simpler exposition. In either formulation the assumption is of course taken to be verified under that condition of absence of new disurbances, which constitutes the necessary premise of the analysis of the tendency of market prices to natural or normal prices (cf. par. 29 below).

[15] It might seem that this third assumption is in conflict with what we said in par. 13 n. 12, about the way in which an increasing speed in the fall of O_h may cause a rise of the ratio O_h/D_h^m, when A_h is a means of production of itself. However, the present assumption concerns the absolute speed of the fall of O_h, and not its variation over time.

[16] For a demonstration of this proposition, see par. 19 below.

or to be produced without any direct labour,[17] in which case the rise of r_h can occur only through route (i).

Which of the two routes (i) or (ii), the rise of r_h will mainly or exclusively take, will depend partly on the technical conditions of production, and partly on what is happening to the prices of the other commodities about which, as already remarked, nothing is postulated here. (It may be interesting to note at this point how, because of our choice of the composite wage commodity as the numeraire, and of our assumption of a constant w, it is only when the rise of r_h involves a rise of m_h relative to wage costs that m_h will have an *absolute* rise as the output of O_h falls. If the rise of r_h is exclusively due to a rise of m_h relative to its means of production, m_h will *not* rise, and will indeed generally fall in its absolute level.)

17. Since however A_h enters directly or indirectly into the production of commodities which in turn enter directly into the production of A_h as means of production or as wage goods, the question may be posed as to whether the effect on other industries of the rise of the relative market price m_h of A_h might not set some obstacle or constraint to that very relative rise of m_h and, therefore, some obstacle or constraints to the rise of r_h. The relative rise of m_h will in fact lower the rate of profits in the industries using A_h as a means of production, and therefore, when that profit rate were to fall below the natural rate, set in motion forces tending to raise it again through rises in the relative market prices of the respective commodities. The question then arises of whether the impact of those secondary rises on the costs of A_h, might not conceivably annul the initial rise of m_h, relative to means of production and wage goods, thus annulling the initial rise of r_h.

The answer to this question lies in the fact that the rate of profits r_h which is rising is the *minimum* in the economy and we are therefore sure, that that rise cannot force any profit rate elsewhere in the economy below itself. As soon as any rate of profits fell as far as r_h because of the rise of the latter, the process we are envisaging would raise it back jointly with r_h (cf. below pars. 20 and ff). Moreover, the rise of r_h will not have to proceed beyond r^* where, as we shall see (par. 19 below), all other rates will also have to be equal to r^*. Indeed, in principle, the rise of r_h could occur with market prices changing elsewhere in the economy so as to ensure that no rate of profits ever falls below r^*.[18]

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[17] Our assumption (par. 6 above) is that labour is required directly *or indirectly* in the production of every commodity. All products being here assumed to be basic, that assumption could be satisfied even if only one of the commodities required direct labour. We cannot therefore exclude the case of A_h having no wage costs (the aging of wine is the example traditionally envisaged of a production process requiring no direct labour).

[18] Cf. par. 19, n. 1 below.

We may thus conclude that the rise of r_h is entirely compatible with the possible secondary effects it may have on the market prices of its direct and indirect means of production. The convergence to natural prices could be prevented by a direct or indirect effect on the production expenses of A_h of its own relative price rise, only if some industries could 'resist' a fall in their profit rates at levels of those rates higher than the natural rate of profits r^*. The fact that this cannot be the case is at one with the assumption of free competition and the associated tendency towards a uniform rate of profits.[19]

18. As r_h continues to rise by finite increments, it will finally have to reach the level of one of the rates of profits obtaining in some other industry, say that for A_{h+1}. There are then two possibilities: either (a) the level reached by r_h is already r^*, or (b) it is less than r^*. As we shall presently see, that level cannot be higher than r^* since, as the minimum rate reaches r^*, all the other rates of profits will also have to be at r^*. To see why that is so and discuss possibilities (a) and (b) we shall however need first some propositions to which we must now proceed.

IV. THREE PROPOSITIONS ON MARKET AND NATURAL PRICES

19. Of the three propositions to be demonstrated in this section, Proposition I (mentioned in par. 2 above) and its strict complement, Proposition II, appear here as a basis for Proposition III, which is the one central to our argument.

PROPOSITION I. *Whatever the deviations of market from natural prices, the production of a commodity A_m for which the ratio M_m of the market to the natural price is the minimum in the economy, will always yield a rate of profits which is below the natural rate.*

Let us indicate by M_1, M_2 ... M_n the ratios of market to natural prices of the n commodities

$$M_1 = \frac{m_1}{p_1}, \qquad M_2 = \frac{m_2}{p_2}, \qquad ..., \qquad M_n = \frac{m_n}{p_n}$$

From the numeraire equations [2] and [5] it follows that either $M_1 = M_2 = ... = M_g = 1$, or if they differ, some of them will be larger and

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[19] Under competitive conditions no 'resistence' to a fall in the rate of profit can be effected in any industry except by means of a fall in the output and of the consequent (eventual) rise of the market price of the product relative to means of production and or wage goods. This will presumably require that the rate of profits has fallen below the natural rate r^*.

some smaller than unity. It may however be noted that the case $M_1 = M_2 = ... = M_g = 1$ does *not* entail $M_{g+1} = ... = M_n = 1$, and that it does not therefore necessarily coincide with the 'natural position' of the ecoomy.

It follows that the minimum such ratio, let it be the ratio M_m for the commodity A_m, need not be less than unity. It is true that if the M's of the wage goods are not all equal, then, as we saw, the M of some wage goods will have to be smaller than unity, and therefore $M_m < 1$. We cannot however rule out the above possibility that the M's for the wage goods will all be equal, and therefore equal to unity, with commodities other than the wage goods having different M's, none of which happens to be less than unity. In that case the minimum M would be unity. (The case we are finding here is the one we already noticed in the example of par. 8, of an excess in the output over the effectual demand for the numeraire commodity which will have to show in a general excess of the market prices of all the other commodities relative to their natural prices.)

In order to simplify the notation, let us now indicate by a the level of the minimum ratio M_m between market and natural prices, pertaining to the commodity A_m, so that we can write:

$$a \leqslant 1 \qquad\qquad [9]$$

Let us also indicate by b the analogous ratio as it applies to the means of production of A_m, taken as a single composite commodity, *i.e.*

$$b = \frac{\displaystyle\sum_{i=1}^{n} a_{im} m_i}{\displaystyle\sum_{i=1}^{n} a_{im} p_i}.$$

We can of course be sure that b, which will be an average of the M's of the means of production of A_m, weighted by the values of those means of production at their natural prices, will not be less than M_m. We cannot however immediately exclude the possibility $a = b$: *i.e.* that for one or more of the commodities (which must then be more than one) having the minimum ratio M_m between market and natural price, the direct means of production of the commodity might all have the same minimum ratio M_m between market and natural price. In that case, the commodity — call it A_1 — would not yet be the commodity A_m we are looking for, and for which we must have

$$a < b \qquad\qquad [10]$$

However, we shall then be bound to find A_m among the means of production of A_1, or among the means of production of those means of production etc. (all showing the ratio M_m), within a number of steps which

cannot exceed $(n - 1)$. This is so because, by hypothesis, some commodity exists with an M larger than the minimum, and since all commodities are basic (par. 6), such a commodity will enter (indirectly) into the production of commodity A_1. Now, until all direct and indirect means of production have appeared through the several stages of the "reduction to labour" (Sraffa, 1960, pp. 34 ff) of A_1, at least one new means of production other than A, must appear at each stage of that reduction: otherwise no new means of production could ever appear at any later stage of the same process. Thus the number of stages we may have before all means of production have appeared cannot exceed $(n - 1)$, since at the first step in the reduction, A_1 and at least one commodity other than A_1 must have appeared as a means of production.

We may now choose as physical unit of the commodity A_m which we shall thus have traced, that which is of unit value when estimated at its natural price for the given r^*. Let v be the proportion of that value taken up by the (circulating) means of production, when estimated at their natural prices, and let u be the analogous proportion taken up by wages. We can then write the market rate of profits obtainable in producing A_m as:

$$r_m = \frac{a - (u + bv)}{u + bv} = \frac{a}{u + bv} - 1 \qquad [11a]$$

and the natural rate of profits as

$$r^* = \frac{1 - (u + v)}{u + v} = \frac{1}{u + v} - 1 \qquad [11b]$$

(where, as we saw in par. 6 above, we assume wages to be at their natural level in dealing with the market prices of equation [7a]).

We must now show that under conditions [9] and [10], $r_m < r^*$, i.e. that

$$\frac{a}{u + bv} - 1 < \frac{1}{u + v} - 1 \qquad [12]$$

$$i.e. \quad \frac{a}{u + bv} < \frac{1}{u + v}$$

Since $(u + v)$ and $(u + bv)$ are both positive, inequality [12] simplifies into

$$u(1 - a) > v(a - b) \qquad [12a]$$

which is always true since $v(a - b) < 0$ by condition [10], whereas $u(1 - a) \geqslant 0$, by condition [9].

As we wanted to show, the production of the commodity A_m having the minimum M, will always give a rate of profits below r^*.

PROPOSITION II. *The commodity, or one of the commodities, having M at its maximum level will necessarily have* $r > r^*$.

This proposition can be demonstrated by a procedure strictly analogous to the one we followed for Proposition I.[1]

PROPOSITION III. When none of the market rates of profit of the n industries lies below the natural rate, then the rates of profits are all equal. They are therefore equal to the natural rate, and we are in the natural position of the economy with market prices equal to the natural prices. The same holds true when none of the n rates of profits lies above the natural rate r^*.

In fact, if in the situation envisaged in Proposition III, the M's were not all the same, then by Proposition I above, we would be able to single out a commodity A_m, such that its production would yield a rate of profits $r_m < r^*$. Since by hypothesis no profit rate lies below r^*, we must conclude that the M's must all be the same. By the numeraire equations [1] and [2], they must then be all equal to unity. We are therefore in the natural position of the economy, with market prices equal to the natural prices, and with a uniform rate of profit r^*.

A strictly analogous reasoning will prove the proposition in the case in which none of the n rates of profits lies above the natural rate.

V. THE CONVERGENCE TO THE NATURAL POSITION

20. We can now return to the level $r_{(h+1)}$ which the rate of profit r_h has reached in its rise, and to the two cases $r_{(h+1)} = r^*$, and $r_{(h+1)} < r^*$, mentioned at the beginning of par. 18 above. Let us begin with the case $r_{(h+1)} = r^*$.

The market rate r_h was the minimum r in the economy, and by the nature of the process envisaged above, it must have remained so. If $r_h = r_{(h+1)} = r^*$, then, by Proposition III, the convergence to the natural position has been achieved.

21. We may proceed to the second case, where the level $r_{(h+1)}$ at which r_h meets the rate of profits of the industry of $A_{(h+1)}$ is below r^*. We can then envisage the continuation of the fall of O_h and rise of r_h, this time jointly with a fall of O_{h+1} and the rise of $r_{(h+1)}$, which is consequent upon that fall for the same reasons we saw in Section III for r_h. For the sake of simplicity, and without loss of generality, we may assume that the

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[1] If now we return to the commodity A_m of Proposition I in the production of which the rate of profits must be below the natural rate r^*, we may note that the production of at least one of the other commodities would have to yield a profit rate higher than r^*. Indeed we cannot exclude that this will be the case for all commodities other than A_m. Thus, as mentioned in par. 17 of the text, we cannot exclude that once one market rate is below r^*, all the others are above that same natural rate.

two rates of profit rise in step,[1] and we shall indicate by H the group of commodities (including A_h and $A_{(h+1)}$ so far) in the production of which the rate of profits is thus made to rise uniformly.

Everything that we said in par. 16-17 above, concerning the rise of r_h, and its possibility, can now be repeated, with the slight reformulations made necessary by the fact that the rate of profits which is rising is the rate r_H, common to the group of commodities H, and not that of the single commodity A_h. Thus, similarly to what we saw in par. 16, the possibility of the rise of r_H obtains because of one, or the other, or both of the following circumstances.

> (i) For at least one of the commodities H, one or more of its means of production must be commodities other than those of group H. This must be so because all commodities are basic and enter therefore, directly or indirectly, into the production of each of the commodities H (par. 3 above): evidently none of the commodities other than H could enter even indirectly into those of group H, if at least one of them did not enter *directly* into the production of at least one of commodities H (thus making it possible for all the commodities outside group H to enter *indirectly* into all those of the group: cf. the same point in the demonstration of Proposition I, par. 19 above). As a result a rise of the rate of profits r_H common to group H can always be achieved by raising the market prices of commodities H sufficiently, relative to those of the other commodities.
>
> (ii) The existence of wage costs for the production of commodities H and, therefore, the possibility of raising the prices of commodities H relative to their wage costs, unless all wage goods are already included in group H, or no commodity of group H required any direct labour to be produced.

22. As in the case of the single commodity A_h, the further question then arises of whether the effect on the profits and prices of the remaining industries of the rise in the rate of profits obtained in the production of commodities H, might not in fact ultimately undo that rise. The answer to this question is the same (par. 17 above): no such obstacle can be met by the rise here required in r_H, which needs to proceed only up to r^* and is therefore compatible with any rise in the market price of the remaining commodities which might be necessary in order to keep the rate of profits obtainable in their production from falling below r_h or indeed below r^*.

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[1] No difference to our conclusions would in fact be made if the two rates did not rise uniformly. The only element on which our present argument rests is that the minimum rate, whether r_h or r_{h+1}, or the two together, should monotonically rise (cf. pars. 13 above and 27 below). The assumption of a uniform rise of the two allows for an easier exposition of the answer to the problems which that rise presents us with, and which we saw in pars. 16-17 for the case of the single commodity A_h.

23. It is now easy to see our way forward to the conclusion of the argument. As $r_h = r_{(h+1)}$ rise in step with each other they will sooner or later meet a third profit rate $r_{(h+2)}$ and there will again be two cases. Either we shall have $r_H = r_h = r_{(h+1)} = r_{(h+2)} = r^*$ and then, by Proposition III, the natural position would have been reached. Or, alternatively, $r_H < r^*$ and then, as commodity $A_{(h+2)}$ joins group H, all three can rise together in exactly the same way we saw above, until they will meet a fourth rate of profit $r_{(h+3)} \leqslant r^*$, and so on and so forth, until the rate of profits r_H common to the thus enlarging group of commodities H finally reaches r^* and hence, by Proposition III, all the remaining rates of profits. In a finite number of steps (that of the commodities joining group H which obviously cannot be larger than the number n of commodities) this process will lead to the normal position of the economy.

24. The fact that nothing is here being postulated about the behaviour of outputs and prices outside the industries H whose profit rate is being increased, may however seem to raise a difficulty, which we should deal with before concluding our argument.

We have assumed a monotonic fall in the output of A_h and more generally of the commodities of group H, in parallel with a monotonic rise in the profit rate r_h obtainable from their production. We cannot however exclude the possibility that in the initial situation, the 'market' effectual demand for A_h — whose proportion to output, as we saw, plausibly governs the sign of the deviation of the market from the natural profit rate (par. 12 above) — will be considerably below the 'normal' effectual demand so that the output of A_h, while larger than the 'market' demand — thus explaining $r_h < r^*$ — will however be below the 'normal' demand. In such a case the convergence to the natural position will ultimately require some *rise* in the output of A_h (and thus not a monotonic fall), and therefore also, presumably, that r_h should rise beyond r^* before falling back to it. In that special case we can see the necessity of a non monotonic movement of the output and rate of profits for one of the commodities H, but of course the *possibility* of such a non monotonic movement is always there, as a profit rate may so to speak 'shoot beyond r^*' (as a result *e.g.* of a particularly rapid fall in the relative market price of its means of production) before getting back to r^*.

However, the phenomenon we have then to envisage is entirely compatible with the process of convergence we have discussed. To see that this is so, it is sufficient to realise that in such cases, r_h will have had to meet some other profit rate $r_{(h+1)} < r^*$, before it could 'shoot beyond r^*'. Its place in the progressive rise towards r^* will then have been taken by $r_{(h+1)}$. In fact our procedure only requires that none of the rates of profits of commodities H, which we accompany in their progressive rise, ever falls back below the uniform level of the group. *Some* rates of profits may well be allowed to go ahead and even 'shoot' above r^*.

25. We may now finally drop the assumption that, during the process envisaged above, the real wage is, and stays, at its natural level w^*, and suppose instead that we have a variable "market" real wage w.

However, the tendency of w towards w^* is a different question from that with which we have been concerned here, and has to do with the forces which allow w to be treated as an independent variable in classical theory. This difference in the forces involved is what has induced us to separate the two questions by supposing that the wage is and remains at its natural level during the adjustments in prices and profit rates envisaged above.

What can be of concern to us here is therefore only whether the two tendencies, that of the real wage towards its natural level, and that of the profit rate and relative prices towards their natural level, might not interfere with each other. For what can be seen from the side of the latter tendency — without entering, that is, into the way in which the market real wage will gravitate towards its natural level —, there do not seem to be grounds for any such interference.

One could in fact argue as follows. At any given level of the market real wage w', the tendency to the general rate of profits r' corresponding to that wage, and the connected tendency to the corresponding series of $m - 1$ natural relative prices, will occur in the way discussed in this paper. This should ensure that, as the general rate of profit r' itself changes by effect of the movement of the market wage w' towards the natural wage w^*, the former tendency will translate into a tendency towards the natural rate of profits r^*.[2]

VI. SOME CONCLUSIONS

26. We may now try to pull together the threads of our argument and assess the meaning of our results. The argument in this paper has been designed to examine the obstacles which the market prices of the means of production have been thought to raise for a tendency towards the normal position of the economy. The paper has thus been focussed on showing that a fall in the output of the industries yielding the minimum rate of profits is sufficient to bring the economy to its normal position, irrespective of what the market prices of the means of production might initially have been or have become in the course of the adjustment.

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[2] The effect of the change in real wages in changing the 'market' effectual demand for commodity A_h (or for the commodities of group H) should not, on the other hand, affect the conclusions we reached in par. 13 above about the fall in O_h ultimately entailing a fall in the ratio O_h/D_h^m. Though it cannot be excluded that the adjustments in the real wage might temporarily cause falls in the market effectual demand D_h^m for A_h which are faster than those of the output O_h, such a faster fall cannot obviously last *if* the market wage gets progressively closer to the natural rate.

27. The results thus reached may however extend beyond the inexistence of those particular obstacles. This may be seen by taking now an overall view of the premises and assumptions used for those results.

Our argument has first of all been founded on the classical postulate of given 'normal' effectual demands. This postulate, which follows from the basic premises of the classical approach (par. 4 above), has in fact been frequently overlooked in recent literature purporting to deal with the classical tendency of actual or market prices towards prices of production. This is a result of the difficulty many authors seem to have in coming to terms with the classical determination of outputs and its independence from the demand and supply forces of present-day mainstream theory. However, overlooking this classical postulate has prevented a sufficiently general treatment of the question and has imposed on that literature special assumptions about normal outputs like that of steady growth.[1] This has in turn favoured the choice of hypotheses about the behaviour of actual prices and outputs, the arbitrary character of which seems to have escaped attention, and to have led to unwarranted conclusions about an instability of the prices of production.

A case in point have been some two commodity models (NIKAIDO, 1985) where the normal position of the economy has been assumed to be that of uniform growth. It has been there assumed that, with real wages included among the means of production, the outputs of the given initial 'market position', whichever they might happen to be, will be totally absorbed for the consumption out of profits and the production of the outputs of the immediately following period, and will determine those outputs accordingly. So if we assume that the production of commodity A_2 requires itself in a proportion to A_1 higher than the production of A_1 does, and, for the sake of simplicity, we further assume a zero proportion of consumption out of profits—then, an initial excess in the supply of A_2 relative to the quantity required for uniform growth would result in an even larger excess supply in the following period. For exactly the same reason the excess supply will be still larger the period after, and so on and so forth up to the point at which the proportion O_2/O_1 will exceed the maximum in which the two commodities can be absorbed (that in which they are required in the production of A_2). Hence Nikaido's conclusion that the natural position is unstable.

It seems however to have escaped notice that such a conclusion would require the relative price of A_2 to be such as to provoke the above increase in the relative output of A_2, i. e. that it should lie *above* the

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[1] As I have had occasion of pointing out elsewhere (GAREGNANI, 1990, p. 52), the assumption of steady growth seems to have been often adopted on the belief that it would allow for an analysis of the average rate of growth of the economy. This overlooks the fact that no reason exists why any such average growth of the real economy should or could ever entail a proportional increase of all sectors and of the employed resources.

natural level, just when the output of A_2 *exceeds* its 'market' effectual demand (which is here equal to the normal effectual demand and bears therefore the proportion of uniform growth to the similar demand for A_1)[2]—contrary to what any competitive bidding would entail. It appears then that when the effects of competitive bidding are correctly taken into consideration, that conclusion of instability can be neatly reversed. A relative price of A_2 *below* its natural level because of the initial excess supply, will result in a progressive fall of the proportion in which A_2 and A_1 are produced towards the single proportion of the natural position of steady growth assumed there, and in that position any excess supply will disappear.[3]

The above conclusion about the stability of the position of steady growth of that model will in fact be true whichever the proportions in which the two commodities are required in the two industries. In either assumption

[2] We have here assumed no consumption out of profits and therefore the demand for consumption good A_2 comes exclusively from wages. The general assumptions of Nikaido's model entail, on the other hand, a level of labour employment which, though growing from period to period, is given in any given period. The *market* effectual demand for A_2 will therefore be equal to aggregate real wages and therefore to the *normal* effectual demand, whatever the market position of the economy (and therefore the reference price m_2^*) might be.

[3] Nikaido's argument may perhaps emerge more clearly by using a simple diagram where the abscissa x measures the proportion O_2/O_1 between the outputs of the two commodities A_2 and A_1 of the model, and the ordinate y measures the proportion in which the two commodities are demanded as inputs when the output proportions are those measured by the abscissa. (The physical unit of A_2 has been chosen so as to require for its (direct) production the whole given labour force of the situation considered (par. 5 above), and the same has been done for the physical unit of A_2.) Fig. B1 then depicts the case in which the production of A_2 is 'self intensive' and
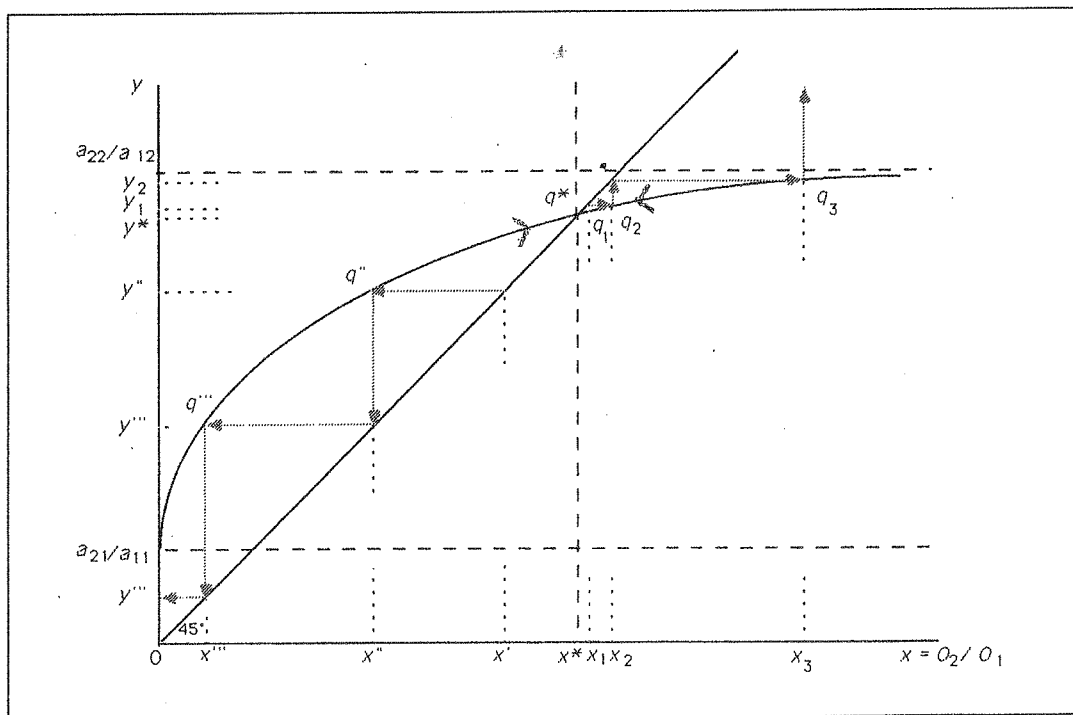

Fig. B1

about the coefficients of production, the excess in the supply of A_2, relative to the quantity likely to be used as input for the production of the subsequent period, will of course result in some accumulation of inventories to be liquidated later, just as the symmetrical shortage of A_1 will have to be made good from inventories. Indeed, by the very fact that a market position is not a normal position of the economy, the kind of

therefore y rises from the minimum a_{21}/a_{11} for $x = 0$, and tends to its maximum a_{22}/a_{12} as $x \to \infty$, while Fig. B2 depicts the opposite case. Suppose now that the relative outputs of the initial situation happen to be x', with a relative market effectual demand which, for the reasons seen in n. 2 above, will correspond to the proportion x^* of uniform growth. Since the size of the employed labour force, though growing over time, is given in each given situation, there will be a positive excess demand for A_2, indicated by the horizontal difference $(x^* - x')$, or the vertical difference between $y^* = x^*$ and the ordinate y' of the bisectrix through the origin. The proportion x'' in which the two commodities should be produced the following year in order to absorb the current outputs of proportion x' can then be found as the abscissa of the intersection q'' between the q curve and the horizontal line drawn from the point $y' = x'$ on the bisectrix (as mentioned in the text we are assuming zero consumption out of profits). As can be seen from Fig. B1, that proportion x'' will have to be further from the steady growth proportion x^* than x' was. The even lower proportion x''' would then indicate the next output proportion required to absorb the two commodities thus produced in the proportion x'', with that proportion then falling finally to zero. Similarly in the case of an initial proportion x_1 of the outputs, with an excess supply of A_2 expressed by the difference $x_1 - x^*$ (also shown vertically by $y_1 - y^*$), the sequence of outputs x_1, x_2, x_3 would show a similar instability. However, the leftward instability disappears as soon as we realize that to be ever realized, the sequence x', x'', x''' would require $m_2/m_1 < p_2/p_1$, which cannot be the case with the output proportion x' smaller than the proportion x^* between the market effectual demands. On the contrary, those proportions will ensure $m_2/m_1 > p_2/p_1$, and will therefore result in a rise of the output ratio towards x^*, not unlike what will be true in Fig. B2 for the similar case of initial excess demand for A_2. The analogous conclusion holds for the supposed rightward instability described above for Fig. B2.
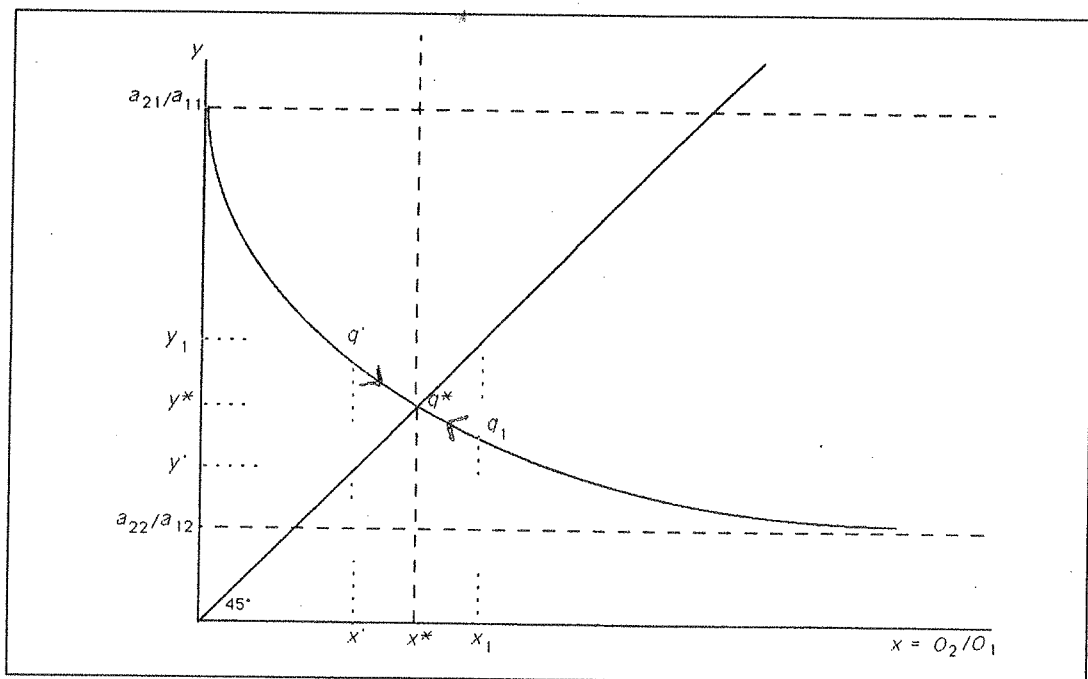

Fig. B2

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market clearing occurring in the former will generally involve some running up or running down of inventories of the commodity.[4]

28. Let us proceed now to the assumptions we made in our analysis. If we leave aside the assumptions of section II regarding the kind of economy with which we have been concerned, similar to those generally made in dealing with our topic, our conclusions have been founded on the two basic assumptions we mentioned in par. 4 above. The first has been the decrease in the output of the industry (industries) yielding the minimum rate of profits the economy (par. 9). The second has been that — leaving aside changes in inventories of the commodity, care of which was taken by the third assumption to be presently discussed — a fall in the proportion which the output of the commodity A_i bears to its 'market' effectual demand, will raise its market price relative to the 'reference' price m_i^* yielding the natural rate of profits in the given 'market position' of the economy, and vice versa (par. 12).

The generality of the first of these two basic assumptions would not appear to be in doubt, since it is based on the tendency of investors to maximise their returns.[5] The second assumption, on the other hand, is a generalisation of Adam Smith's postulate about the market price exceeding the natural price when the output of the commodity falls short of the normal effectual demand, and vice versa.[6] It seems therefore to be no more disputable than Adam Smith's own postulate.

29. A third assumption of a more restrictive nature has however been also used by us. The assumption is that, instead of *eventually* rising as demonstrated in par. 13-14 above, the minimum rate of profits will rise monotonically, up to the level of the natural rate. As we noted (par. 15 above), that need not necessarily be true because the ratio of the output of the commodity to its market effectual demand may temporarily rise rather than fall. Also, the liquidation of inventories of some commodity A_h of group H may temporarily depress the rate of profits in the corresponding industry, even when O_h/D_h^m is falling. In all those cases the minimum rate of profits of the economy would temporarily fall.

The restrictions which this third assumption has imposed on our argument may be summed up by saying that it has excluded the possibility of any but convergent oscillations in reaching the normal position of

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[4] Those running up or running down of inventories would probably be generally considered as 'unintended'. It does not however seem to be simple to distinguish such 'unintended' inventory changes, clearly connected with reservation prices and, therefore, with expectations about future prices, from 'intended' inventory changes.

[5] The implications of the possibility of a temporary rise of the output in the least profitable industry because of the lag between production decisions and realised outputs (par. 9 above) will be considered presently.

[6] Cf. par. 12 above.

economy. Oscillations of constant or even widening amplitude of the profit rates in some industries, had not in fact been ruled out by our demonstration of the *ultimate* rise of a profit rate which happens to be the minimum in the economy. Those oscillations, unlike those of decreasing amplitude, have instead been clearly ruled out by our assumption of a monotonic rise of the minimum rate of profits of the economy.

Before considering in the light of our previous analysis the sources and likelihood of such constant or widening oscillations, we must however remind the reader about a possible ambiguity concerning them, and make clear the nature of the oscillations we only need be concerned when discussing a tendency to normal prices and outputs. The oscillations around the normal position which can always be expected to occur in the actual economy, will generally arise from the continuous occurrence of *exogenous* accidental circumstances. However, by their nature, these oscillations are excluded from an analysis of the tendency of the economy towards its normal position. If that tendency can be shown to exist — given an arbitrary initial deviation from that position, and in the absence of further disturbances — there will then be grounds to conclude that the deviations caused by the continuously occurring exogenous disturbances will tend to compensate each other over a sufficiently long period of time, and that the market price will gravitate *around* (rather then *towards*) the natural price.

The oscillations relevant for the analysis of the tendency to natural prices are therefore only those of a different, endogeneous kind, and these are the oscillations which have been ruled out by our third assumption. However, it appears that the previous argument by which we could prove, in par. 13-14 above, the eventual rise of the minimum rate of profits, had already left little room for any but convergent oscillations.

In fact there seem to be only two possible sources of those constant or divergent oscillations which have been ruled out by our third assumption. The first is the time lag between production decisions and realized outputs, for which O_h might temporarily rise even when A_h is a minimum-profit commodity (cf. condition [6] above, about an *eventual* fall of O_h). We have implicitly excluded the effect of that lag to the extent that the monotonic rise of r_h entails a corresponding fall of O_h/D_h^m and therefore, presumably, of O_h, whenever A_h is a minimum-profit commodity. Now by assuming away those effects we have also assumed away the possibility of phenomena like the 'hog cycle'. The possibility is that for which in some industries a low rate of profits might cause decisions to decrease output which, when put into effect, will reveal themselves to have been excessive, thus causing a sharp rise in the profit rate above the natural level and, conceivably, a rise of output, causing then the profit rate to fall even below its initial level, and so on and so forth, with constant or increasingly wide oscillations.

The second conceivable source of constant or widening oscillations of individual profit rates, ruled out by our third assumption, are inventory

cycles of the commodity concerned. Although for the reasons we saw in par. 14 we cannot imagine a liquidation of inventories of the commodity to cause an indefinite fall of the rate of profits yielded by its production, yet the rise in relative price (and profit rate and hence inventories) following upon the end of that liquidation, might provoke as a reaction a new liquidation bringing the profit rate even below the minimum level previously reached, and so on and so forth.

However, with respect to the second source of oscillations the reasons we saw at par. 14 above make it difficult to envisage the possibility of such widening inventory cycles. It would in fact seem that the effect of those cycles on the prospective profit rate obtainable by producing the commodity, would tend to be confined within narrow limits by the analogous opposite effects on that rate due to the changes in output, and hence in supply, caused by those very cycles. Those cycles would also tend to be narrowly confined by the fact that as the rate moves away from the normal level, the inventory change would run counter plausible expectations about the long-run behaviour of the relative price of the commodity.

On the other hand, with respect to the first possible source of divergent oscillations, the lag between production decisions and realized outputs relevant for the 'hog-cycle' phenomena (we are of course abandoning here our assumption about all capital being circulating capital) will chiefly concern the short-period decisions regarding the outputs obtainable from existing plant.[7] The long-period decisions concerning the size of plant will presumably have the time to be revised as the gradual effects on the relative price of the commodity of the short-period decisions will reveal themselves.

It seems, therefore, that when the demonstrated ultimate rise in the rate of profits has narrowed the possibilities of instability in the prices of production down to the above cases of divergent oscillations, the conclusions about any instability of prices of production would have to be negative. As far as I can see, those possibilities of non-convergent endogenous oscillations would rest only on the possibility of indefinitely repeating, on the same, or on an increasing, scale, the errors made possible either by the lags between output decisions and realized outputs, or by changes in the inventories of the commodity.[8] Until convincing examples are brought to

[7] Cf. par. 9, n. 2, par. 11, n. 6, above.

[8] A word might be added about the continuity we have here implicitly assumed for the changes in prices and outputs — a continuity which can only be viewed as an approximation (especially in our present argument for which we have assumed a yearly cycle of production, and therefore some discontinuity in the changes of outputs if not in those of prices). It does not however seem that this assumption has in any way affected our conclusions. Even in the case of an economy with only two commodities — where discontinuity might seem essential to oscillations, since when the two market rates of profits became equal in the course of their continuous change no further endogenous changes might seem to be possible — even in that case, production lags, rather than discontinuity are what is essential for oscillations. In fact continuity in the variation of the relative prices would not prevent 'overshooting', to the extent to which changes in output when the two rates of profit are equal will respond to decisions taken when they were unequal.

the fore to the contrary, it would seem legitimate to suppose that in those cases individuals could and would learn from their experience and that any such endogenous oscillations in the markets of individual commodities[9] would tend to decrease in amplitude.[10]

30. A feature of the argument put forward in this paper may finally be commented on. Following the method of the classical economists, we have attempted to confine the assumptions on which our argument has rested to the *signs* of the changes in the relevant variables (a fall in the least profitable output O_h, a rise in r_h as O_h/D_h^m falls, etc.) The importance of this lies in the first place in that the simplicity of those assumptions allows for their direct comparison with, and hence confirmation (or lack of it) by, observation. No less importantly, these assumptions are by their nature quite general, since nothing is there postulated about the *size* of the rates of change over time of outputs and prices.[11] They render therefore possible equally general conclusions. This generality and this possibility of conclusive comparisons with observation are on the other hand essential for a problem as central as the tendency to the position of the economy determined by the theory, on which the validation of classical theory, as of any conceivable alternative theory, appears to depend.

The fact that — once some essential premises of classical theory, like that of given effectual demands, are correctly understood and taken into account — results appear to be achievable by means of such simpler and more general assumptions confined to the signs of the changes, seems on the other hand to confirm the basic correctness of that classical method.

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[9] Oscillations of aggregate demand are of course a question different from that of the tendency of market prices to their natural levels and have in fact been excluded by the classical assumption of given 'normal' effectual demand (par. 4 above).

[10] Thus, taking as an example the 'cobweb' of a divergent 'hog cycle' (*e. g.* SAMUELSON 1980, p. 381-2), it would seem difficult to imagine that producers — far from learning about their errors in excessively increasing and then decreasing their outputs, and that speculators, far from taking advantage of any such persisting, visible errors — would allow them to be repeated on an ever increasing scale.

[11] Except of course for the *finiteness* of those rates of change, which has been assumed throughout the paper.

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