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contents

Some Comments on Recent Contributions on Capital Accumulation, Income Distribution and Capacity Utilization

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1. INTRODUCTION

The purpose of this essay is to critically appraise some recent contributions devoted to the analysis of the long-run relationship between capital accumulation, income distribution, and capacity utilization[1].

Firstly, we shall introduce the contributions by Rowthorn and Amadeo, since their long-run models seem to share the same approach[2,3]. As we shall see in Section II, the "equilibrium" utilization degree that emerges from the steady-state solution of their models will in general be different from its "normal" level: because of this, both authors negate the general validity of the inverse relation between the real wage rate, on the one hand, and the profit rate (or the rate of accumulation), on the other. This result appears to be in contrast with the features traditionally attributed to steady states, where a "normal" degree of capacity utilization is

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[1] Cf.: E. J. AMADEO, "Notes on capital utilisation, distribution and accumulation", in *Contributions to Political Economy*, 1986, 5, pp. 83-94; R. CICCONE, "Accumulation and capacity utilization: some critical considerations on John Robinson's theory of distribution", in *Political Economy*, vol. 2, n° 1, 1986, pp. 17-36; R. ROWTHORN, "Demand, real wages and economic growth", orig. in *Thames Papers in Political Economy*, Autumn 1981, reprinted in *Studi Economici*, n° 18, 1982, pp. 3-53; F. VIANELLO, "The pace of accumulation", in *Political Economy*, vol. 1, n° 1, 1985, pp. 67-87.

[2] A similar approach is adopted by L. TAYLOR, *Structuralist Macroeconomics*, New York, Basic Books, 1983 and A. K. DUTT, "Stagnation, income distribution and monopoly power", in *The Cambridge Journal of Economics*, n° 8, 1984, pp. 25-40.

[3] The one-good assumption introduced by the authors will be maintained throughout the present paper, since it allows us to keep our argument in as simple terms as possible, without affecting the substance of the problems under discussion. Problems of aggregation are ignored, and the analysis is carried out in terms of an "average firm", whose characteristics are assumed to represent those of the economy as a whole; furthermore, in order to abstract from possible shortages of labour, its supply is assumed to be unlimited.

assumed to prevail in all sectors and to be maintained over time. The systematic under (or over) utilization that characterizes Rowthorn and Amadeo's steady states leads us to inquire, in Section III, what kind of expectations are implicit in their investment functions, and whether their fullfillment can be made consistent with situations of systematic non-normal utilization of capacity.

Finally, in Section IV, we shall discuss the countributions by Vianello and Ciccone.

2. ROWTHORN'S AND AMADEO'S MODELS. (A) THE HYPOTHESES ON TECHNOLOGY AND DISTRIBUTION: THE PROFITS CURVE. (B) THE STEADY-STATE EQUILIBRIUM OF THE MODEL

In the simple economy assumed by the authors, real net profits are defined as[4]

$$P = X - W - \Delta \qquad [1]$$

where X is the level of real global output, W is the total wage bill in real terms, and Δ is total depreciation, which is assumed to be a constant fraction δ of the amount of corn-capital K.

Dividing equation [1] through by K gives the rate of net profits:

$$P/K = (X/X^0)\,(X^0/K) - w\,(N/N^0)\,(N^0/X^0)\,(X^0/K) - \Delta/K, \text{ or}$$
$$r = (u/k - \delta) - (u/ak)\,w \qquad [2]$$

where r is the profit rate and w is the real wage rate. Equation [2] can also be put in the form

$$r = (m/k)\,u - \delta \qquad [2']$$

with m defined as $m = 1 - w/a$.

Equation [2] implies that at any given degree of capacity utilization there exists a linear inverse relationship between the real wage rate and the rate of profits obtainable with the current techniques of production[5]. On

[4] The economy is closed and without a State; there are only two classes, workers and capitalists, these latter acting also as entrepreneurs. The social product is divided entirely between wages (which are paid at the end of the productive cycle) and profits; land is free and no rent is paid for its use. Production requires only labour and fixed capital. Only one type of good, say, corn, is produced, and this can be used both for personal consumption and as fixed capital. Fixed capital requires no maintenance and its operating characteristics remain unchanged throughout its lifetime. Techniques of production and the length and intensity of the working year are given and do not change through time. The capital: capacity output ratio $k = K/X^0$ is given, and labour productivity is constant: this latter is expressed as $a = X^0/N^0$, where N^0 is the maximum number of workers employable at full capacity. The degree of capacity utilization is indifferently expressed as $u = X/X^0$ or as $u = N/N^0$.

[5] The same relation between w and r can be arrived at starting from the following price equation: $p = w_m\,(1/a) + (r + \delta)\,p\,(k/u)$. Just like equation [1], this latter is only an accounting relationship,

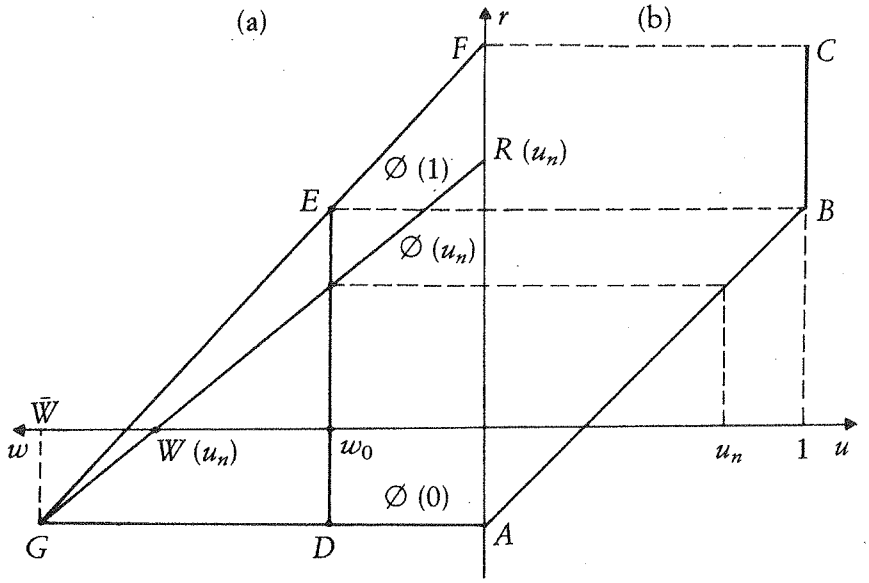

Fig. 1. Relations between the real wage rate, the net profit rate, and the degree of capacity utilization. Panel (a): family of curves ∅, describing the relation between w and r for any given u. Panel (b): profits curve, giving the relation between r and u for a given w (in particular, AB = Amadeo's profits curve and ABC = Rowthorn's profits curve).

the other hand, equation [2′] implies that r is a linear function of u for any given real wage. The curve generated by equation [2′] will be referred to as the "profits curve"[6].

Equations [2] and [2′] are represented, respectively, in panels (a) and (b) of Fig. 1.

In panel (a) we have drawn the family of curves ∅ generated by equation [2], each curve being associated with a particular value of u.

which says no more than that what is not paid out as wages is (gross) profit. In fact, the price of corn is the sum of: *a*) the labour cost w_m/a, where w_m is the nominal wage rate; *b*) the cost of seed corn $\delta p\ (k/u)$; and *c*) the net profit earned on seed corn, $rp\ (k/u)$. By solving this equation for r we obtain the same expression as in [2].

[6] Equation [2′] is basically what Rowthorn defines as the "profits curve". This curve is derived by the author by supposing that firms set their prices by adding a given mark-up θ over current marginal costs c, expressed in money terms: $p = (1 + \theta)\ c$, where $c = w_m/a$; then, the real wage rate is given by $w = w_m/p = w_m/[(1 + \theta)\ (w_m/a)] = a/(1 + \theta) = (1 - m)\ a$, where $m = \theta/(1 + \theta) = (p - c)/p = = (1 - w/a)$ is an index of the so-called "degree of monopoly". According to this approach, given labour productivity a, the real wage is entirely determined by the degree of monopoly, and varies inversely with this latter; w depends on the money wage rate only to the extent to which changes in w_m affect m or a. On Rowthorn's profits curve, cf. also the following note. The concept of a profit function of this kind was originally put forward by JOSEF STEINDL, *Maturity and Stagnation in American Capitalism*, Oxford, Basil Blackwell, 1952, pp. 111 and 211. Notice that equation [2′] is equivalent to Amadeo's equation [1], cf. E. J. AMADEO, *op. cit.*, p. 84. Differences arise because his expression refers to the gross rate of profit (Amadeo's r is in fact equal to our $r + \delta$) and the degree of capacity utilization is defined as the output: capital ratio X/K, which correspond to our u/k.

$R(u_n) = (u_n/k) - \delta$ is the maximum rate of net profits technically obtainable at the "normal" degree of utilization, $W(u_n) = (1 - \delta k/u_n)\, a$ is the real wage compatible with a zero rate of gross profits with u taken at its normal level, while $\bar{W} = a$ is the real wage corresponding to a zero rate of net profits (which is independent of u). Point G is the only point in common among the different $\emptyset$-curves: as u increases from zero to unity, the curve shifts upwards, pivoting around G until it reaches its highest position $\emptyset$ (1).

In panel (b) the "profits curve" has been drawn, showing the profit rate obtainable on the basis of the existing techniques and with the real wage rate taken at its current level. In graphical terms, this curve can be constructed as follows. Suppose that the real wage is given at w_0; as u increases from zero to unity, the $\emptyset$-curve starts pivoting upwards around G: thus, the given w will be consistent with a higher and higher profit rate and, at the same time, we will be moving towards the right along the positively sloped segment AB of the profits curve in panel (b)[7].

Now, as a point on a single $\emptyset$-curve indicates the rate of profit that would obtain at a given w if the amount of output implicit in that utilization degree were sold in the market, and since the prevailing u depends itself on demand conditions, this simple apparatus enables us to distinguish between what Professor Steindl has recently called, in this Journal, "antagonistic changes in distribution" (i.e. shifts of income from wages to profits with given utilization) and "changes in surplus value realised" (i.e. changes in utilization which involve changes in the product and in the profits with a given real wage)[8].

As is illustrated in Fig. 2*a*, the first kind of change is to be identified with movements along a $\emptyset$-curve, which imply shifts of the profits curve. Fig. 2*b* depicts the second kind of change, implying movements *across* $\emptyset$-curves, which are in turn associated with movements along the profits curve.

We must now pass to an examination of how the prevailing degree of capacity utilization is determined, and hence how the point on the

[7] The fact that Rowthorn's profits curve is represented by the kinked curve ABC calls for some words of explanation. Rowthorn supposes that in the presence of excess capacity, or when demand matches the full capacity output exactly, the mark-up θ remains constant at a given level $\bar{\theta}$; when demand exceeds capacity output, θ becomes free to vary above the previous level, in accordance with the going excess demand. In other terms we have $\theta = \bar{\theta}$ for $0 \leqq u < 1$ and $\theta \geqq \bar{\theta}$ at $u = 1$. Because of this assumption about θ (and hence on m), real wages turn out to be independent of demand when there is excess capacity, whereas at full capacity any increase in demand causes prices to rise and real wages to fall: in particular, w tends to zero as θ tends to infinity. We have then that $w = (1 - \bar{m})\, a$ for $0 \geqq u > 1$ and $0 \leqq w \leqq (1 - \bar{m})$ a at $u = 1$, where $\bar{m} = \bar{\theta}/(1 + \bar{\theta})$. Therefore, at full capacity the relation between w and r will be represented by the segment EF on the highest $\emptyset$-curve; correspondingly, the vertical segment BC of the profits curve obtains.

[8] Cf. J. STEINDL, "Distribution and Growth", in *Political Economy*, vol. I, n° 1, 1985, p. 55.

∅-curve (or, what amounts to the same thing, the point on the profit curve) is determined.

The equilibrium can be determined in a number of equivalent ways, which have been used interchangeably in the literature. In what follows, we shall refer to the equilibrium condition that net savings by society as a whole (relative to capital) must be exactly equal to the desired rate of net accumulation, i.e. $h^s = h^i$, where $h^s = S/K$ and $h^i = I/K$[9].

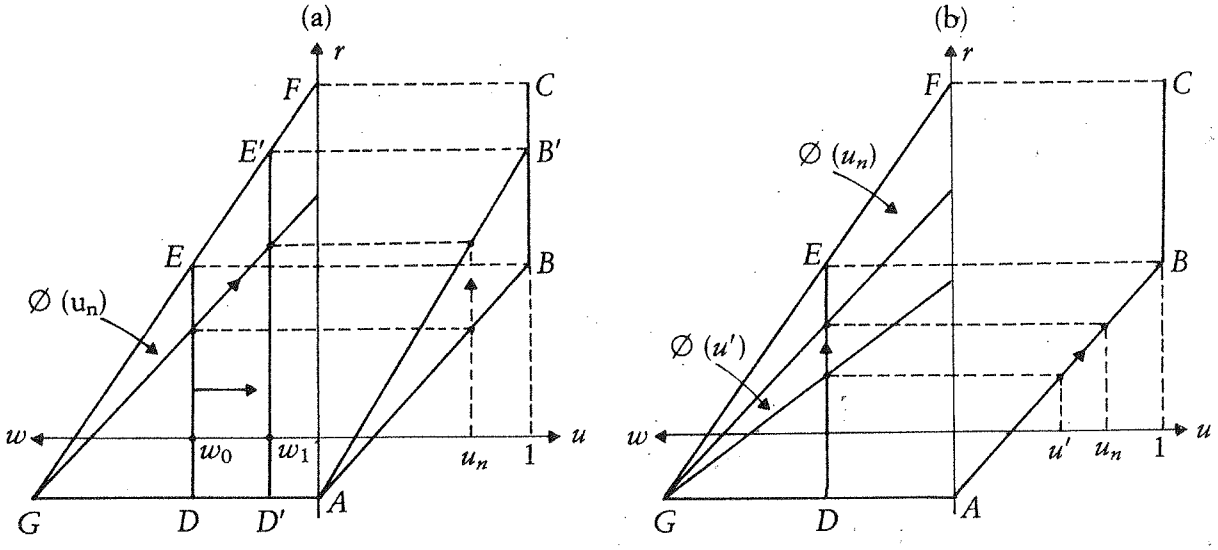

Fig. 2. Panel (a): an "antagonistic change in distribution", represented by a fall in the real wage rate at a given utilization degree u_n. Panel (b): a "change in surplus value realized", represented by an increase in the utilization degree from u' to u_n, given the real wage rate.

Decisions to save can be expressed as $h^s = s_w\ (W/K) + s_k\ (P/K)$, where s_w and s_k are, respectively, the workers' and capitalists' propensities to save. Taking into account that $(W/K) = w\ (u/ak)$, and substituting [2'] for (P/K) we obtain:

$$h^s = [s_w\ (1 - m)/k + s_k\ (m/k)]\ u - s_k\ \delta \qquad [3]$$

Assuming that workers' propensity to save is zero, [3] boils down to

$$h^s = s_k\ (m/k)\ u - s_k\ \delta \qquad [3']$$

[9] Although perfectly equivalent, Rowthorn's approach differs slightly from the one presented in this section, as the equilibrium u is obtained through the intersection between the profits curve and the so-called "profits realization curve". Cf. Appendix 1.

Under the further assumption that s_k equals unity, the saving curve would coincide with the profits curve [2']. In all cases, saving decisions per unit of capital turn out to be a linear function of u.

As to investment decisions, Rowthorn introduces a linear investment function of the form

$$h^i = h_0 + h_1 r + h_2 u \qquad [R]$$

while Amadeo assumes

$$h^i = h_3 + h_4 (u - u_n) \qquad [A]$$

The choice of the arguments of the function is a matter of economic interpretation, and will be discussed in more detail later on[10]. For present purposes, however, the desired rate of net accumulation can be taken as a function of u alone, since the rate of profit is itself a function of utilization, if w is given. Substituting [2'] for r into [R] and collecting the terms in u gives:

$$h^i = \alpha + \beta u \qquad [4]$$

where, in Rowthorn's and Amadeo's versions we have, respectively

$$\alpha = h_0 - h_1 \delta \quad \text{and} \quad \beta = h_1 (\dot{m}/k) + h_2 \qquad [4R]$$

$$\alpha = h_3 - h_4 u_n \quad \text{and} \quad \beta = h_4 \qquad [4A]$$

Given this, the steady-state equilibrium of the economy is determined by the intersection (if there is one) between the saving and investment curves[11].

[10] As to the rate of interest, Rowthorn assumes the existence of "a banking system which is costless to run and provides credit to industrial firms at a zero interest rate": cf. R. ROWTHORN, *op. cit.*, p. 15. Amadeo, for his part, is less explicit on the subject: the interest rate is apparently taken as given. In either case, therefore, the question of how the rate of interest is determined and how it influences savings and investments is side-stepped altogether. As to the so-called "animal spirits", representing the psychology and the state of confidence of the business comunity, Amadeo holds explicitly that their influence would be reflected by the "intercept" of the function. This interpretation seems to be in conflict with the opinion expressed by J. Robinson (cf. J. ROBINSON, *Essays in the Theory of Economic Growth*, London, Macmillan, 1962, p. 38), according to which "animal spirits" would not enter the investment function as an explicit argument, but would govern the *shape* of the function: if this is correct, both α and β would reflect animal spirits. For similar arguments, cf. D. J. HARRIS, *Capital Accumulation and Income Distribution*, London, Routledge & Kegan Paul, 1978, pp. 188-9 and S. A. MARGLIN, *Growth, Distribution and Prices*, Harvard University Press, 1984, p. 80.

[11] By equating [3'] and [4] and solving for u we get the equilibrium value of the utilization degree:

$$u^* = (\alpha + s_k \delta) / [s_k (m/k) - \beta]; \qquad [Eu]$$

then, by substituting (Eu) for u into [4] and [2'] gives, respectively, the equilibrium values for the net accumulation rate and the rate of profits:

$$h^* = s_k [\alpha (m/k) + \beta \delta] / [s_k (m/k) - \beta] \qquad [Eh]$$

$$r^* = [\alpha (m/k) + \beta \delta] / [s_k (m/k) - \beta] \qquad [Er]$$

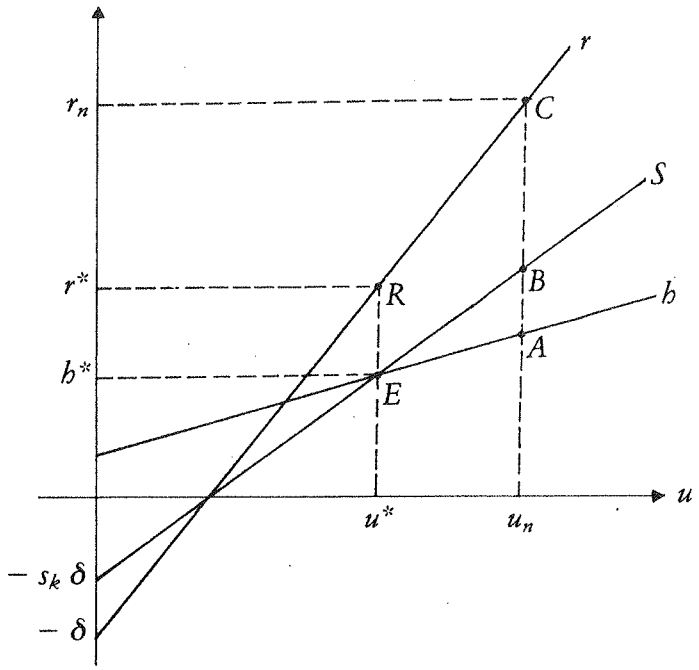

Fig. 3. The determination of the steady-state equilibrium between saving and investment decisions.

As is intuitive, the stability of equilibrium requires the slope of the saving curve be greater than the slope of the investment curve[12], i.e.

$$s_k\,(m/k) > \beta \qquad [5]$$

Next, we examine the effects of a change in the real wage rate. As is easy to check, in Amadeo's version of the model the equilibrium values of u, r, and h all rise unambiguously, as a result of an increase in w, if the workers' propensity to spend is greater than the capitalists'. As to Rowthorn, the influence of a change in w on r^* and h^*, also depends on h_2, the responsiveness of investment decisions to changes in u. In particular, if h_2 is positive the same results as Amadeo's obtain; if h_2 is zero, a change in w will leave r^* and h^* unaffected[13].

[12] For a more detailed discussion of stability, cf. Appendix 2.

[13] As to Amadeo, we have

$$\left.\begin{aligned} \delta u^*/\delta w &= (s_k/ak)\,(\alpha^A + s_k\delta)/A \\ \delta r^*/\delta w &= (\beta^A/ak)\,(\alpha^A + s_k\delta)/A \\ \delta h^*/\delta w &= s_k\,(\delta r^*/\delta w) \end{aligned}\right\} > 0 \text{ if } s_k > 0$$

where $\alpha^A = h_3 - h_4\,u_n$, $\beta^A = h_4$, and $A = [s_k\,(m/k) - \beta^A]^2$; as to Rowthorn we have

$$\left.\begin{aligned} \delta u^*/\delta w &= [(s_k - h_1)/ak]\,[h_0 + (s_k - h_1)\,\delta]/R \\ \delta r^*/\delta w &= (h_2/ak)\,[h_0 + (s_k + h_1)\,\delta]/R \\ \delta h^*/\delta w &= s_k\,(\delta r^*/\delta w) \end{aligned}\right\} \begin{aligned} &> 0 \text{ if } s_k > h_1 \\ &> 0 \text{ if } s_k > h_1 \text{ and } h_2 > 0 \\ &= 0 \text{ if } h_2 = 0 \end{aligned}$$

where $R = [s_k\,(m/k) - \beta^R]^2$ and $\beta^R = h_1\,(m/k) + h_2$.

For illustrative purposes, it is convenient to focus on Amadeo's version of the model. Suppose that, starting from an initial equilibrium state, there is an increase in the real wage rate (due, say, to a reduction in the "degree of monopoly" m).

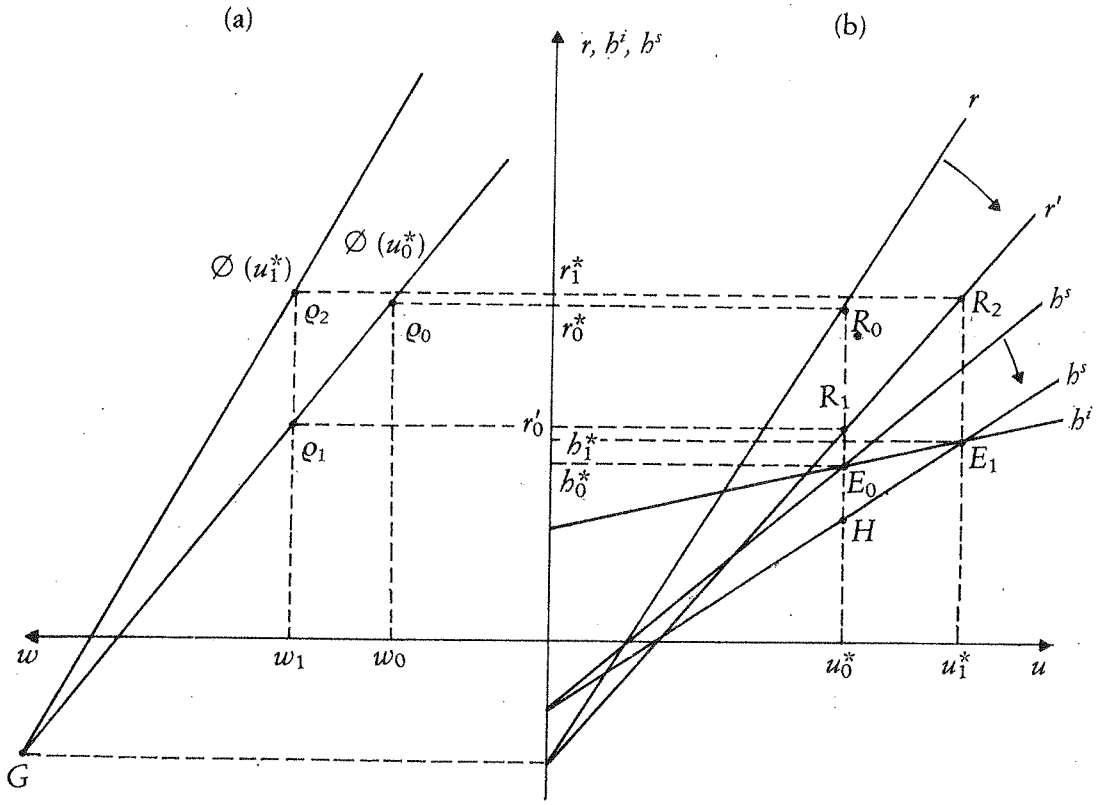

Fig. 4. Effects of an increase in the real wage rate from w_0 to w_1.

This increase is mirrored by a downward shift of the profits curve, and hence by a reduction in the rate of profit technically obtainable at the initial utilization degree u_0^* [cf. point R_1 on the new profits curve in panel (b) of Fig. 4]; at the same time, we move from point ϱ_0 on the curve $\varnothing(u_0)$ to point ϱ_1 on the same curve, in panel (a). Yet, as the saving curve shifts downwards, investment decisions will exceed saving decisions at the given utilization degree[14]; the corresponding excess demand (whose

[14] It is a feature of Amadeo's investment curve that its slope is invariant with respect to changes in w. In Rowthorn's version, this slope is inversely related to the real wage rate: thus, as w rises, the slope of the investment curve will diminish. However, as shown in detail in Appendix 1, also for Rowthorn an increase in the wage rate creates an excess demand at the initial equilibrium utilization degree, if the workers' propensity to spend is greater than the capitalists' (i.e. if $s_k > h_1$).

amount relative to capital is given by the distance E_0H) will bring about an increase in u, which eventually settles down at the new level u_1^* (the stability condition [5] would ensure this). Thus, the economy will reach the new equilibrium position represented by point E_1 in panel (b); correspondingly, we move from point ϱ_1 to point ϱ_2 on the higher curve $\emptyset$ (u_1) in panel (a). Therefore, as a result of the increase in w, a rise in u^*, r^*, and h^* obtains.

Now, the time has come to gather the threads of our exposition. It seems possible to list the following points, on which we shall focus in the next section.

(I) In the approach of both authors, "long-period analysis" is predominantly based on steady states, also called "equilibrium positions" of the economy. The identification of long-period analysis with steady states appears to be unduly restrictive, given the highly artificial features of steady states[15]. Rowthorn seems to be well aware of this limitation when he admits that his discussion of stability is not intended "to specify the

[15] As Harris has observed, "given the nature of steady-state... equilibria, a question of movement from one equilibrium to another cannot arise. Every equilibrium involves a specific stock of means of production appropriate to the technique in use and an appropriate set of expectations about the future which will be fulfilled. The description given so far provides no information on how such movement or process of change could occur". The very nature of steady states would limit the cognitive import of a comparative equilibrium analysis, which would be restricted to comparisons between "different economies, each moving through time along its own equilibrium path without any relation existing between them". Cf. D. J. HARRIS, *op. cit.*, pp. 37-8. Given this, it is natural to ask what is the relevance of such an artificial construct for analysing the actual, historical accumulation processes, which exhibit patterns of cyclical, unsteady, and uneven growth. It seems possible to distinguish two different attitudes with which steady states have been used by their proponents. On the one hand, steady states are conceived as *hypothetical* states of the economy, and used as a device to "fix ideas" at a very preliminary level of analysis, not to analyse economies as they are. In particular, they are used as "a logical framework to answer interesting questions about what ought to happen" (cf. L. PASINETTI, "Rate of profit and income distribution in relation to the rate of economic growth", *The Review of Economic Studies*, 29, Oct. 1962, p. 279) or as "a reference point against which various patterns of imbalance can be studied and their causes investigated" (cf. D. J. HARRIS, *op. cit.*, p. 38). There is, of course, nothing bad or wrong about this approach, as long as we are prepared to revise our preliminary results when the focus of attention is shifted to more general conditions. On the other hand, steady states appear to be intended as a means to predict *actual* tendencies or, at least, as an useful reference point for the study of concrete situations. Kaldor's work represents one of the neatest examples of this attitude: his "stylized facts" were viewed as broadly consistent with the picture of steady states. In particular, steady states would be used as a device "to separate long-run from short-run influences" (cf. J. ROBINSON, *The Accumulation of Capital*, London, Macmillan, 1956, p. 66) or "for abstracting from the business cycle" (cf. S. A. MARGLIN, *op. cit.*, p. 9). In other terms, if our interpretation is correct, steady states would be taken to account for the observed "trend" of accumulation, emerging from the ups and downs of the business cycle. If this is so, such a use of steady states would need to be supported by a general stability argument which, to our knowledge, has not yet been provided. However, even if one suceeded in providing a formal stability proof, the feeling would still remain that this exercise would in fact be wholly sterile, as we would be trying to adapt reality to the artificial features of the steady state. Furthermore, the implicit conception of steady states as *terminal points* of a complex adjustment process (which may in fact require a very long time to be completed) would devoid the comparison between different steady states of any pratical relevance for the study of changes in real economies.

actual process of transition from one steady growth path to another, nor to consider more complex behaviour than steady growth"[16].

(II) In both versions of the model, there is the possibility of utilization being *different* from its normal degree, even in states of equilibrium (and, indeed, actual and normal utilization would coincide only by a mere fluke). This result appears to be in contrast with the features traditionally attributed to steady states, where a normal utilization degree is assumed to *prevail* in all sectors and to be *maintained* over time, as demand grows in harmony with the expansion of capacity, owing to the assumption of self-sustained fulfillment of expectations (in the light of which all decisions, and investment decisions in particular, are taken). The *systematic* under — or over — utilization of productive capacity that characterizes Rowthorn's and Amadeo's steady states[17] leads us to ask what kind of expectations are implicit in their investment functions, and whether their fulfillment can be made consistent with situations of systematic non-normal utilization of capacity. It is in fact clear that, as long as investors are *on* their demand schedule, there would be no apparent incentive to move away from such a state of "equilibrium".

(III) Thirdly, "the possibility of capacity utilization being different from its planned degree in the long run" would have "an important implication for theories of distribution and accumulation"[18]. In particular, "the old Classical notion that 'a unique, inverse relation must obtain in the long period between the real wage and the rate of profit' will not necessarily obtain"[19], at least "up to the point where the economy reaches a situation

[16] Cf. R. ROWTHORN, *op. cit.*, p. 6.

[17] Supposing that a stable, under-utilization equilibrium state exists, along the steady-growth path there would obtain an increase in the *absolute* amount of "undesired" excess capacity, i.e. the capacity exceeding that required to produce the equilibrium output at a normal utilization degree. In other terms, the stock of capital would expand although it is not utilized in a satisfactory way. Furthermore, from the standpoint of society as a whole, this would imply an increasing loss of capital $\tilde{K}$, given by the difference between the capital that would have obtained had the economy grown at the "normal" rate h_n (cf. point B in Fig. 3) and its actual capital at time t:

$$\tilde{K}_t = [(1 + h_n)^t - (1 + h^*)^t] K_o.$$

In Garegnani's terms, this loss can be expressed as

$$\tilde{K}_t = s_n x_o [(1 + s_n o)^t - (1 + h^*)^t] / (s_n o - h^*)$$

(cf. P. GAREGNANI, "Summary of the Paper 'Some notes for an analysis of accumulation'", presented at the Conference *Theories of Accumulation and the Control of the Economy*, Udine, 1982, pp. 3-6), where $x_t = X_{nt} - X_t$ is the loss of production due to lack of effective demand, $s_n = (S/X)_n = s_k (m - \delta k/u_n)$ is the normal net marginal propensity to save in the economy and $o = [(X - \Delta) / K]_n$ is the normal net output: capital ratio. In his paper, Garegnani implicitly assumes a stationary economy, where $h^* = 0$ and $x_o = x_1 = x_2 = \ldots = x$.

[18] Cf. E. J. AMADEO, *op. cit.*, p. 91.

[19] Cf. E. J. AMADEO, *op. cit.*, p. 83. Amadeo's quotation refers to P. GAREGNANI, "Notes on consumption, investment and effective demand II", in *The Cambridge Journal of Economics*, 1979, 3, p. 77 n.

of full utilization of capacity"[20]. In other terms, the *realized* rate of profit emerging from the interplay between distribution and effective demand may not be inversely related to the real wage, even in situations that the authors seem not to think limited to the short period; another way to say this is that the "ex-ante" or "normal" rate of profit r_n (i.e. the rate of profit technically obtainable at the normal utilization degree with w taken at its current level) may diverge from the realized rate, even for long periods of time. Now, we do not wish to quarrel with this reasonable proposition: the *observed* rate of profit is very unlikely to coincide with r_n, even in terms of averages covering long periods of time, although we might suspect that, after all, there must exist *some* connection between the two rates. The model, however, contains no element for the exploration of this connection, as it implies a persistent and systematic divergence between u^* and u_n.

In the next section, then, we shall examine the investment function in more detail, as it plays a crucial role in the authors' analysis.

3. SOME CRITICAL REMARKS ON THE INVESTMENT FUNCTIONS USED BY THE AUTHORS; THE INCONSISTENCY BETWEEN EXPECTATIONS ON DEMAND AND THE STEADY-STATE SOLUTION OF THE MODEL

As we have seen in the course of the previous exposition, the desired rate of net accumulation is taken by Rowthorn as a linear function of two distinct arguments: the current rate of profit and the current degree of capacity utilization. Amadeo, on the other hand, assumes h^i to be a function of u alone.

In order to appraise these theses, it is convenient to keep the influence of the profit rate distinct from that of current utilization on investment decisions.

As to the influence of the profit rate, it is generally acknowledged that investment decisions are positively related to the *expected* rate, while the current profit rate is only taken as a proxy for this latter. Now, in the absence of expected changes in techniques and real wages, the expected rate can be defined as $r^e_{+1} = (m/k)\, u^e_{+1} - \delta$; u^e_{+1} can, in turn, be thought as the ratio between expected sales (for simplicity, we abstract from changes in inventories) and the productive capacity to be installed in period $t + 1$. This is sufficient to show the clear connection between investment decisions and expected demand or, to be more precise, its expected rate of growth. In what follows, we shall try to accomodate sales

[20] Cf. E. J. AMADEO, *op. cit.*, p. 81.

expectations as an explicit parameter of the simple (linear) functional form chosen by the authors[21]. Before doing this, let us pass to the examination of the other argument of the function.

Rowthorn states that the current degree of capacity utilization influences investment decisions "directly in its own right", and not only "indirectly, through its effect on profits"[22]. Such a direct influence, defined by Rowthorn as "acceleration effect", is what Amadeo is seemingly referring to when speaking of the "endogeneity of capacity utilization"[23]. In this regard, unanimous reference is made to Steindl's analysis. Basically, investment decisions are viewed by Steindl as aiming to restore the normal utilization degree (at a certain speed and on the basis of demand expectations), whenever the current utilization rate falls short of (or rises above) its "normal" level. This latter, in general, will be well below its attainable maximum, in some technological sense: in his analysis, a *deliberate* holding of excess capacity by individual producers (as distinguished from the excess capacity arising from a variable state of demand) is explained as a "reserve held in anticipation of future events, or in view of some existing uncertainty"[24]. The circumstances determining the size of planned excess capacity and hence the "normal" or desired utilization degree, will also

[21] On the other hand, it is suggested that current (i.e. realized) profits stimulate investment activity because they "provide internal funds for accumulation" and because higher profits "make it easier for a firm to raise external finance" (Cf. R. ROWTHORN, *op. cit.*, p. 17; Rowthorn's argument supposes implicitly that $s_k = s'_k + s''_k (1 - s'_k)$, where s'_k is the "retention rate" and s''_k is the propensity to save out of distributed profits). In other terms, the availability of internal savings out of current profits (i.e. retained earnings) would fix a barrier beyond which investment activity could not be carried out without resorting to an "excessive" indebtedness. Investment decisions would then be related to the current rate of profit through the *constraint* represented by the funds retainable out of current profits. Now, quite apart from the fact that this is in sharp contrast with Rowthorn's assumption of a banking system which provides credit at a *zero* real interest rate, it is apparent that this relation need not be either linear or stable, as the constraint may turn out not to be binding at all when the incentive to invest is low (when, for example, the expected expansion of the market is low). These doubts are reinforced by the fact that s_k appears itself to be dependent on the amount of investment that firms desire to finance out of current profits. In conclusion, there seems to be no reason to suppose the existence of a stable linear relationship between h' and r. Although arguing on different lines, Amadeo also comes to a similar conclusion. Amadeo argues that "capacity utilization (rather than the rate of profit) should be seen as the most important index of changes in aggregate demand and, therefore, an essential determinant of investment demand". In particular, the rate of profit "becomes theoretically meaningless" as an argument for the investment function since it is "a variable firms can control through movements in the profit margin" in the face of changes in the utilization degree. (Cf. E. J. AMADEO, *op. cit.*, p. 89) Amadeo's argument, however, is inconsistent with his profits function which, as we have shown in note 6, is based on a *fixed* mark-up.

[22] Cf. R. ROWTHORN, *op. cit.*, p. 17.

[23] Cf. E. J. AMADEO, *op. cit.*, p. 89. In the light of the above discussion, however, Amadeo's terminology is confusing: in fact, u would be determined "endogenously" (i.e. as an unknown of the model) even if the desired rate of accumulation were taken as given.

[24] Cf. J. STEINDL, *Maturity, op. cit.*, p. 9. In particular, such a deliberate holding of excess capacity would find its basic motivations in the experienced or expected fluctuations in demand (or expected growth in demand) which, in conjunction with the indivisibility of capital equipment, and given the individualistic nature of a competitive system, would make it profitable for an individual

determine the complementary amount of *undesired* excess (or deficiency) of capacity. It is this latter, in fact, that can plausibly be assumed to influence the desired rate of net accumulation, as by definition it suggests that firms will endeavour to eliminate it through changes in the accumulation rate[25]. The crucial indicator of undesired excess (deficiency) of capacity in clearly identified by Steindl with the discrepancy between the *current* and the normal utilization degree[26].

Now, we do not wish to discuss Steindl's investment function; however, from the elements introduced above, the "intercept" of Amadeo's function can plausibly be taken to express the expected growth rate of sales, with h_4 representing the speed of a firm's response to discrepancies between the current (realized) utilization degree and its normal level. Such a function, then, implies that when u_t equals u_n firms will simply let their productive capacity grow at the same rate as expected sales. It should be noticed that, according to this interpretation, investment decisions per unit of capital would be taken on the basis of *given* expectations on sales growth, not yet subject to any revision induced by experience[27].

In what follows, we shall explore further implications of this investment function.

The discussion carried out so far has aimed to suggest that the expected growth of sales is embodied in the parameters of the investment function(s) used by the authors. As an immediate consequence of this, the equilibrium state of the economy appears to be conditional on given expectations about sales growth. This peculiar feature of the model makes it forcefully evident that its steady-growth solution, expressing the "long-run equilibrium" for the economy, cannot be thought of as a situation

producer to adopt a policy of "building ahead of demand" (*Ibidem.*, pp. 9-13). This would account for "the elasticity which the system shows, in ordinary times, in face of rapid changes of effective demand" (*Ibidem.*, p. 10).

[25] Suppose u_n is given, and let it be proportional to the "normal" sales: capital ratio. If the actual utilization degree falls short of u_n, the ratio between current sales and capital will turn out to be lower than the normal one: thus, the question is open as to what firms can do in order to restore an "appropriate" sales: capital ratio. As is clear, they could try *either* reducing prices, resorting to more intensive advertisement, etc., in the expectation of getting back a greater volume of sales, *and/or* decreasing the rate of net accumulation below the rate at which future sales are expected to grow, say, μ (notice that if μ is positive, the desired accumulation rate need not take on negative values). Now, Steindl's argument seems to imply that firms will choose the second strategy, because they *expect* it to be more effective; the *actual* effectiveness of this strategy, however, will depend on the interactions occurring in the system as a whole.

[26] Cf. J. STEINDL, *Maturity, op. cit.*, pp. 127-8.

[27] Of course, it would be possible to "endogeneize" μ by supposing that expected sales (or their expected rate of growth) follow an adaptive pattern, or by supposing that μ is equal to the current (realized) rate of growth of sales. In this case, however, we would not obtain an investment function of the same form as the one chosen by the authors, since h_t^i would depend also on the *past* values of u. At the same time, equation [A2.3] in Appendix 2 should be replaced by an equation of the form $h_t = f(h_{t-1}, h_{t-2}, \ldots)$. In this new and more complex context, the existence and the stability of a steady-growth path would not be such an obvious matter as in the model under discussion.

where, to use Harrod's words, producers are "content with what they are doing"[28] because their expectations are being confirmed by actual experience: on the contrary, the *given* expectations on demand held by producers would not in general be consistent with the dynamic of *actual* sales ensuing from their behaviour. The problem is evident if we look at the "equilibrium" state of the economy, expressed by point E in Fig. 3: in such a state, all the relevant magnitudes of the economy, actual sales included, would be growing at a constant rate h^*; in principle, this situation obtains through the adjustment rule (A), which in its turn depends on the expected growth of sales. Now, since μ has been taken as given by assumption, there would be nothing in the model to ensure the equality between h^* and μ: as is clear, this equality would obtain only if u^* happened to coincide with u_n. In other words, entrepreneurs would behave in a totally irrational way, holding expectations about sales which are permanently frustrated by the experience. Producers would be "content with what they are doing" only to the extent to which they behave irrationally. In this sense, steady states characterized by a *permanent* under- or over-utilization of productive capacity can be viewed as arising from "wrong" expectations held by producers.

As we have noted before, what is lacking here is some mechanism of expectations revision. Supposing that the "equilibrium" utilization degree happens to be lower than its normal level, it will result that $h^* < \mu$. In these circumstances, firms are likely to react by adjusting their expectations on sales growth to the lower actual rate. A reduction in μ feeds back, in turn, into the investment function, and this triggers a cumulative process which, at least apparently, could last until all investment and production activity is extinct[29].

The instability inherent in the steady-growth solution of the model is itself sufficient to show that it cannot be taken as a simplified basis for analysing the accumulation processes in *real* economies, which are not subject to such wild gyrations in levels of activity and in rates of growth.

[28] Cf. R. HARROD, *Towards a Dynamic Economics*, London, Macmillan, 1966, p. 81.

[29] In fact, it is easy to show that $(\delta u^*/\delta\mu)$, $(\delta h^*/\delta\mu)$, and $(\delta r^*/\delta\mu)$ are all positive: the change in μ will bring about a downward shift of the equilibrium position; in turn, this entails a further reduction in h^* and hence in μ, and so forth. Since $-s_k\,\delta$ (i.e. the value of the "intercept" of the saving schedule) is greater than $-\delta$ (i.e. the minimum level at which the rate of net accumulation can fall), it is apparent that this process has no positive lower limit. This paradoxical result is due, however, to the intrinsic limitations of the model which, inter alia, focuses on a "representative firm". Strictly speaking, it is implicitly assumed that the output shares of different firms (plants) are *fixed*: thus, the device of a representative firm prevents an analysis of what happens outside the steady-growth path. In particular, it seems plausible to think that, as the recession protracts, some firms will go bankrupt, so that their capital will "vanish" and, at the same time, the surviving firms will gain higher market shares. Therefore, as the composition of the representative firm changes, forces are set in motion to counterbalance the cumulative process. At any rate, it is not clear why and how the economy should go back to the steady path previously abandoned.

The general conclusion is that we are faced with a drastic alternative: either (a) the economy happens to find itself in a steady state, where producers' expectations are being confirmed by actual experience (i.e. we have $u^* = u_n$ or, what amounts to be the same, $h^* = \mu$: in this case, the economy will keep on growing along the steady path, in the absence of perturbations) or (b) the "equilibrium" utilization degree does not coincide with its normal level, and hence producers' expectations are not being confirmed by experience. In this case, as the economy moves away from the steady path, the model has nothing to say about the long-run tendencies of capital accumulation.

4. THE CONTRIBUTIONS BY VIANELLO AND CICCONE

Vianello's paper endeavours to explore that part of the theory which Sraffa left unexplained, namely the part of the theory where *quantities* are determined.

According to the author, Sraffa's equations of production are implicitly based on "fully adjusted situations", defined as "situations in which a uniform rate of profit prevails, and the productive capacity installed in each industry is exactly sufficient to produce the quantities that the market absorbs when commodities are sold at their natural prices"[30]. Thus, a fully adjusted situation (FAS for short) is such that "producers will be content with what they are doing", in that "the equipment with which they have endowed themselves is exactly that which enables them to produce those quantities without moving away from the normal degree of utilization of productive capacity"[31].

Yet, in Vianello's view, a FAS is to be distinguished from the "warranted path" expressed by a steady state, which is "based on the hypothesis that productive capacity is *continuously* kept at its normal degree of utilization"[32] and where "producers *continue indefinitely* to be content with what they are doing"[33]. As we shall see in a moment, this distinction seems to be motivated by the fact that while the FAS are assumed to be "centres of gravity"[34], towards which the system adjusts through changes in the utilization rate and in the amount of productive capital, this quality is not attributed to steady states as such, so that the "warranted path" is referred to "solely as a term of comparison for fully adjusted situations which are *not* deployed along any such path"[35].

[30] Cf. F. VIANELLO, *op. cit.*, p. 70.
[31] *Ibidem.*, p. 81.
[32] *Ibidem.*, p. 72.
[33] *Ibidem.*, p. 81.
[34] *Ibidem.*, p. 84.
[35] *Ibidem.*, p. 81.

Although Vianello carries out his analysis with a two-sector model, the gist of his argument can be caught with the help of the simpler one-sector model used in the previous sections.

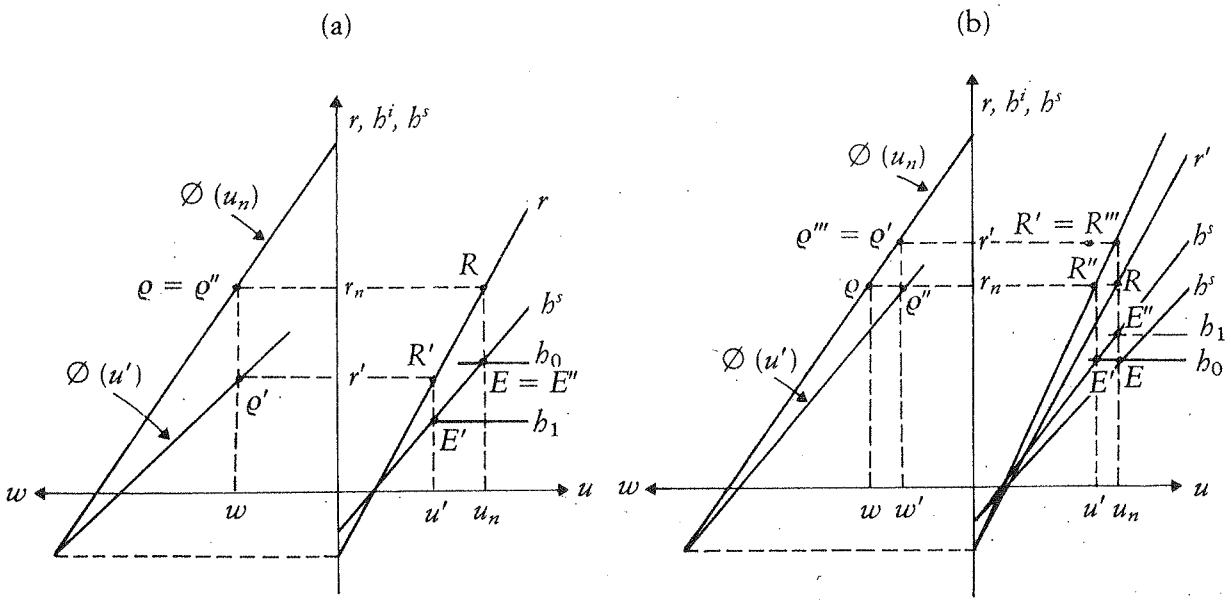

Fig. 5. Effects of (a) a fall in h, given w and (b) a fall in w, given h in Vianello's analysis.

Suppose the economy finds itself at point E, which corresponds to a steady-growth path such that $u^* = u_n$ and $h_0 = \mu$. Vianello assumes that this initial state is perturbed by a change (e.g., a reduction) in h, given w (cf. panel a of Fig. 5) or by a change (e.g. a reduction) in w, given h (cf. panel b of Fig. 5). In both cases, the assumed perturbation gives rise to an excess supply at the initial degree of utilization: thus, the economy will move to point E', where the utilization degree is less than u_n and hence $h < \mu$ (notice that while in the first case r falls, in the second it remains constant). This, in Vianello's opinion, will entail a negative feedback on the accumulation rate (due to firms' attempt to eliminate the undesired excess capacity), and hence on effective demand.

Now, the author *assumes* that "the tendency to produce under normal conditions will prevail, eventually leading to a new fully adjusted situation"[36]. In other terms, after an intermediate period where "profits have been kept abnormally low by the under-utilization of productive capacity"[37], the economy will settle down at point E'', where we have

[36] *Ibidem.*, p. 82.
[37] *Ibidem.*, p. 82.

again that $u^* = u_n$ and, presumably, $h = \mu$. Notice that while in the first case the accumulation rate turns out to be equal to its initial level h_0, in the second it must rise to h_1.

Then, Vianello points at the following "paradox": on the one hand, in either case the accumulation rate observable in the "new" FAS *has not fallen* with respect to the initial situation; on the other hand, the adjustment to the new FAS, which is carried out through disinvestment and capital destruction[38], implies that "productive capacity, production and employment are all lower than if the economy had continuously grown at the 'warranted' rate (h_0)"[39]. A symmetrical paradox would obtain in the case of a rise in h (given w) or a rise in w (given h). Therefore, Vianello concludes that "the rate of accumulation observable in the fully adjusted situations... appears to be a suitable indicator of income distribution, rather than of the actual pace of accumulation"[40]; in particular, such a rate would not give us "*any* information on the actual pace of accumulation"[41].

Vianello's argument is rather intriguing, and requires careful examination. It hinges on comparisons between two "adjacent" FAS's. The author holds explicitly that the system will always tend to *reach* a FAS, whenever its initial state is perturbed; in particular, the FAS are conceived as *terminal points* of a complex adjustment process, *to be attained at some specific moment of time.* Such a process, which involves changes in the utilization rate, disinvestment and capital destruction, is left unspecified, as well as the time span required for the economy to pass from one FAS to another, although the author seems inclined to think that this latter is *very long*[42]. If this is so, then, it is quite natural to think that the comparison between the accumulation rates "observable" in two adjacent FAS's (i.e. at two distinct and, possibly, very distant moments of time) does not allow us to draw conclusions about the actual pace of accumulation *within* the period required to pass from one FAS to another. In other terms, the accumulation rate observable in the "new" FAS could not be taken to represent the *average* rate of accumulation within the period, unless the system were thougth to oscillate around a trend line of steady growth; Vianello, however, does not adopt this assumption, and his intent is that of showing

[38] *Ibidem.*, p. 71: "crises and 'capital destruction' provide a solution to the problem of overabundance of capital, and are one of the means by which the productive capacity installed adjusts to the requirements of production".

[39] *Ibidem.*, p. 82.

[40] *Ibidem.*, p. 71.

[41] *Ibidem.*, p. 85.

[42] Cf., for example, the following passage: "Let us suppose that *at a given moment of time* the economy finds itself in a fully adjusted situation, and let us suppose that *after a period of, say, ten years it is again in a fully adjusted situation*" (*Ibidem,* p. 71).

the "serious limitations involved in the steady-state hypothesis"[43]. If no stability is attributed to the steady state as such, then the only information that an FAS is able to give is that, *if* the economy finds itself in such a situation, and *if* the "normal" rate of profit is positive, the accumulation rate will also be positive, since it is linked with the profit rate by the equilibrium condition $h = s_k r$: therefore, the economy will be growing *at that precise moment of time*. In this sense, an FAS is devoid of any pratical relevance for the study of long-run tendencies.

In addition, it is not easy to grasp in what sense the under- (or over-) utilization of productive capacity ensuing from the adjustment process should be thought of as a "temporary phenomenon"[44]. Instead, one would be tempted to turn the argument upside down, classifying as "permanent" these states of under- or over-utilization of capacity and as "temporary" the FAS's themselves, since these latter, if ever attained in reality, are highly unlikely to be maintained over time.

In conclusion, Vianello does not seem to provide a substantial contribution towards an understanding of how a long-period theory of output could be shaped in Sraffa's theory: in particular, the basic difficulty seems to lie in the fact that Sraffa's production prices are viewed as anchored to situations like FAS, which by their very nature are devoid of any pratical relevance for the study of long-run tendencies.

Like Vianello, Ciccone also holds that Sraffa's long-period prices refer to "normal" conditions of production, and hence to a "normal" degree of capacity utilization, which firms endeavour to restore through their investment decisions and on the basis of demand expectations. Unlike Vianello, however, Ciccone does not carry out his analysis on the assumption that such a normal utilization degree should actually obtain at some particular moment of time. His aim is to provide, as it were, a more "flexible" notion of normal utilization, on which Sraffa's long-period prices could be based[45].

[43] *Ibidem.*, p. 85. In connection with this point, Vianello's contention that the accumulation rate observable in an FAS is a "suitable indicator of income distribution" should be qualified (note that the author assumes $s_k = 1$, so that the saving curve coincides with the profits curve and hence the accumulation rate h observable in an FAS always coincides with the corresponding r). On the one hand, a change in the real wage rate entails an opposite change in the "*potential*" amount of net profits technically obtainable per unit of output and/or capital at any given utilization degree. On the other hand, the profits per unit of output and/or capital *realized on average* during the process which brings the economy from one FAS to another may well differ from the ones observable in the new FAS. When speaking of income distribution, Vianello seems to refer to the "potential" profits, not the realized ones.

[44] *Ibidem.*, p. 82.

[45] Ciccone understands the "long period" as "a time span that is sufficiently long for the gravitation of prices and quantities produced around their respective normal values to manifest itself"; such a notion of long period would leave "evident room for the fluctuations in quantities and prices and the disappointments of expectations that occur in reality", cf. R. Ciccone, *op. cit.*, p. 23.

The author clearly identifies the normal utilization rate as the rate that producers expect to realize on averages covering long periods of time. This concept of normal utilization entails, in our opinion, a significant change in the definition of "undesired" excess capacity, and hence in the way that investment decisions intended to restore the normal utilization degree should actually be shaped. In particular, in Ciccone's view the "undesired" excess capacity seems to be connected to the discrepancy between two (lagged) moving averages, namely: *a*) the average utilization realized in the recent past, $\bar{u}$; *b*) the average utilization degree that producers expect to realize in future periods, $\bar{u}^e$. Ciccone freely admits that these two averages are connected, as $\bar{u}^e$ is to a large extent estimated on the basis of $\bar{u}$[46], so that the former may in fact adjust to the latter over time. Yet, this conception provides the basis for arguing a certain "sluggishness" of response of investment decisions to discrepancies between the *current* utilization rate and its normal level: this sluggishness of response is a reasonable feature of investment decisions, which are usually connected to *long-term* expectations. If this is true, entrepreneurs would not let themselves be fooled by an unexpected change in the current utilization degree, and would refrain from modifying their investment plans until their expectations turned out to be systematically frustrated by experience. Ciccone merely provides an extension of Steindl's argument, drawing some implications that Steindl himself seemed reluctant to develop explicitly. The focus of attention is shifted from a generic (expected) level of demand to its *expected fluctuations*: the desired size of plant would in fact be related to the expected *peaks* in demand and, for this reason, the normal utilization degree will be inversely linked with the "breadth and frequency of the expected falls in production with respect to the peaks for which capacity is adequate"[47].

The sluggishness with which investment decisions react to discrepancies between current and normal u would not, of course, prevent the tendency of $\bar{u}^e$ to adjust to $\bar{u}$; at any rate, the general implication of this approach is that these processes, which do influence the average accumulation, will be relatively slow, and will not result in dramatic changes in levels of activity and in rates of growth. As a matter of fact, the adjustment of the size of capacity to aggregate demand would be assimilated to those factors that influence the *secular* path of accumulation[48]. Furthermore, such sluggishness would not hinder significantly the tendency towards an

[46] R. Ciccone, *op. cit.*, p. 36.

[47] *Ibidem.*, p. 27. In our previous discussion of Steindl's argument (cf. p. 172) we have deliberately omitted any consideration of the role of expected fluctuations in demand. This exclusion, whose sole intent was to concentrate on Rowthorn's and Amadeo's investment functions, may be justified on the ground that their model does *rom./* produce oscillations.

[48] This is in full keeping with the theses advanced by Steindl in his *Maturity and Stagnation.*

uniform rate of profit (if competitive conditions are assumed to prevail throughout the economy), which is based on transfers of capital from one industry to another.

In sum, Ciccone seems to move in the right direction towards an understanding of the relationship between long-period positions of the economy and effective demand: in particular, the former are conceived as situations which by their very nature are sufficiently rooted in the minds of economic agents, but from which the economy is allowed to deviate, though not abruptly.

In our opinion, this conception of normal position is perfectly compatible with the principle of effective demand, in that it does not restrict the analysis of accumulation to such artificial constructs as steady states. Somewhat paradoxically, however, none of the authors dealt with in the present paper (the writer included, with the exception of Steindl and Kalecki) has provided definite propositions about *real* accumulation processes. It is our impression that much work still remains to be done in this direction.

Finally, there remains the question as to whether we can ever hope to observe an (even approximate) correspondence between the rate of profit realized on average and its normal level which, as we have seen, refers to the "normal" degree of capacity utilization. This is tantamount to asking whether there are forces capable of keeping the average actual utilization rate in line with its normal level. On the basis of various observations made earlier in the present paper, we would like to suggest that while actual average rates may diverge from their normal levels, these deviations will be contained within certain bounds, which may vary according to the prevailing conditions.

Banca d'Italia, Roma (*)

(*) The opinions expressed in the present paper are those of the author and are not necessarily shared by the Bank of Italy.

APPENDIX 1

In this Appendix, a list of possible alternative (and equivalent) methods for determining the equilibrium state of the economy is presented.

Firstly, as is clear, equilibrium can be determined by the intersection between the *real net supply schedule* and the *real aggregate demand schedule*, defined respectively as

$$y = (X - \Delta)/K = (1/k)\, u - \delta \qquad [A1.1]$$

$$d = (C_w + C_k + I)/K = [(1/k) - s_k\,(m/k) + \beta]\, u + \alpha - (1 - s_k)\,\delta. \qquad [A1.2]$$

Alternatively, as a result of the assumption that workers do not save, u^* could be determined by the intersection between the *profits curve* already defined (cf. eq. 2′) and the *capitalists' real demand schedule.*

$$d_k = (C_k + I)/K = [(1 - s_k)\,(m/k) + \beta]\, u + \alpha - (1 - s_k)\,\delta. \qquad [A1.3]$$

This latter method highlights the fact that in the present model profits are always realized by the consumption and investment expenditure of capitalists. In fact, the real wages of workers employed to produce any given amount of output always give rise to an equivalent demand for consumption; hence, the realization of net profits corresponding to the remaining part of real net output will be entrusted exclusively to the capitalists' demand for net investment and consumption.

Thirdly, the equilibrium utilization degree could be arrived at by the intersection between the profits curve and the so-called "*profit-realization curve*"[49].

This curve is obtained by substituting the investment function and the saving function (taken in the form $h^s = s_k\, r$) into the equilibrium condition $h^s = h^i$ and solving for r; by doing this, we again get r as a linear function of u. In Amadeo's and Rowthorn's versions we have, respectively:

$$r^A = (h_3 - h_4\, u_n)/s_k + (h_4/s_k)\, u \qquad [A1.4]$$

$$r^R = h_0/(s_k - h_1) + [h_2/(s_k - h_1)]\, u \qquad [A1.4']$$

[49] Cf. R. ROWTHORN, *op. cit.*, pp. 17-9. The concept of realization curve was introduced for the first time by J. ROBINSON, *Essays, op. cit.*, p. 48, and it was subsequently used (and given this name) by D. J. HARRIS, *op. cit.*, p. 189. In the analysis of these authors, however, the utilization degree appears to be treated as fixed at its normal level, even in the course of the adjustment process to equilibrium (i.e. in the "short run"). For a much more explicit approach, cf. MARGLIN's "fixed-coefficient version of the neo-Keynesian model" (S. A. MARGLIN, *op. cit.*, pp. 69-95).

r^A (or r^R) is the value that the profit rate should take on at any give u in order to put saving and investment decisions into equality; in this sense, it shows the rate of net profits that can be exactly realized, without either excess demand or excess supply, at any given utilization degree. As is clear, equilibrium occurs at the intersection point, where the profit rate indicated by the profits curve equals r^A (or r^R).

In order to stress the complete equivalence of these approaches, it is easy to verify that they give rise to the same "*excess supply function*", expressing the excess supply per unit of capital xs as a linear function of u[50]:

$$\begin{aligned} xs = y - d = r - d_k = h^s - h^i = s_k\,(r - r^A) = \\ = (s_k - h_1)\,(r - r^R) = [s_k\,(m/k) - \beta]\,u - (\alpha + s_k\,\delta) \end{aligned} \qquad \text{[A1.5]}$$

Finally, following Kaldor[51], we could determine u^* by using a "*supply price schedule*", taken either in the form

$$p^s = w_m/w \qquad \text{(with } w \text{ given)} \qquad \text{[A1.6]}$$

or, since $w = (1 - m)\,a = a/(1 + \theta)$, in the form

$$p^s = (1 + \theta)\,(w_m/a) \qquad \text{(with } w_m \text{ given)}, \qquad \text{[A1.6']}$$

and a "*demand price schedule*" obtained as follows. From equation (Eu) in note 8, with expresses the equilibrium degree of capacity utilization, we can infer a relation between the price level p and u, since $m = 1 - (w_m/pa)$. Substituting this expression for m into (Eu) and solving for p gives

$$p^d = s_k\,(w_m/a)\,u/[(s_k - \beta k)\,u - (\alpha + s_k\,\delta)\,k] \qquad \text{[A1.7]}$$

The demand price schedule shows, for a given money wage rate, the price level (and hence the real wage rate) that should prevail at any given utilization degree in order to have neither excess demand nor excess supply. Notice that at points above the curve an excess supply obtains, since the workers' propensity to consume is by assumption greater than

[50] Notice that the partial derivative of xs with respect to w (holding u constant) is $(\delta xs/\delta w)_{\bar{u}} = -\,s_k\,\bar{u}/ak$ if α and β are interpreted as in [4A] and is $(\delta xs/\delta w)_{\bar{u}} = -\,(s_k - h_1)\,\bar{u}/ak$ if α and β are interpreted as in [4R]. Therefore, it will be negative if s_k is positive (in Amadeo's version) or if $(s_k - h_1)$ is positive (in Rowthorn's version): in other terms, an increase in w always reduces the excess supply at a given utilization degree if the workers' propensity to spend (equal to unity) is greater than the capitalists' (equal to $1 - s_k$ in Amadeo's case and to $1 - s_k + h_1$ in Rowthorn's).

[51] Cf. N. Kaldor, "Economic growth and the problem of inflation", in *Economica*, August 1959, pp. 216-220 and "Capital accumulation and economic growth", in F. A. Lutz, D. C. Hague, eds., *The Theory of Capital*, London, Macmillan, 1961, pp. 197-201.

capitalists'; by the same token, at points below the curve, an excess demand obtains. In the space (p, u), equilibrium occurs at the intersection point between the two curves, where the supply price equals the demand price. Notice that a change in the money wage will shift both curves upwards, thus affecting the "equilibrium" value of p but leaving u^* unaltered.

APPENDIX 2

In this Appendix, we shall discuss some possible interpretations of the ways in which "stability" can be treated in the context of the model presented in the main text. This will give us the opportunity to point to some ambiguities implicit in Rowthorn's argument.

At first sight, stability of equilibrium could be argued along the following lines. Let us again consider Fig. 3, which is repeated here for ease of exposition.

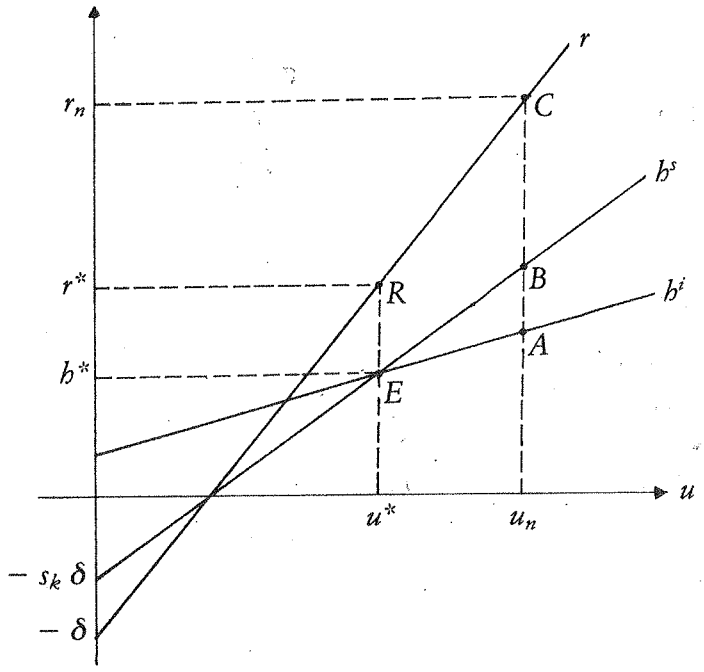

Fig. 3. The determination of the steady-state equilibrium between saving and investment decisions.

If the degree of capacity utilization happened to be higher than is indicated by the equilibrium point E, entrepreneurs would be forced to reduce u, since real aggregate expenditure would be less than output supplied. Such an excess supply (whose amount relative to capital is shown by the distance AB) would obtain with a real disposable income equal to the output supplied; then, a fortiori, expenditure will be less that output supplied if, as a result of the failure to realize this latter, disposable income is itself less than output supplied. In other terms, firms would accumulate unsold goods at current prices, and some of the profits indicated by point C on the profits curve could not be realized. Analogously, entrepreneurs would have an incentive to increase u whenever this was initially below the equilibrium level. Only at the intersection point E are the two groups of decisions put into equality, and only at E can the rate of profit shown by the profits curve be exactly realized.

Notice that the above argument, as it stands, does *not* imply that the economy should actually move along any of the curves in the diagram. For instance, the excess supply which obtains at values of u greater than the equilibrium level u^* (say, at $u = u_n$) implies that the realized rate of profits must fall short of its "potential" level indicated by the profits curve at the same u; on the other hand, at values of u less than u^* there will be excess demand for goods, and the potential r can be fully realized. In any case, outside equilibrium neither savers nor investors would be exactly on their respective schedules, unless some specific assumptions are made. The analysis above only implies that, as long as disequilibrium prevails (i.e. as long as $u \neq u^*$), forces are set in motion which bring the economy *towards* point E; as a matter of fact, this adjustment process may well overshoot, and there is no presumption that equilibrium should actually be reached at some specific moment of time[52]. In addition, notice that in the present context the only possible values of r and u that can be defined as "realized" are their respective equilibrium values r^* and u^*.

This interpretation, however, does not seem to be the one suggested by Rowthorn and Amadeo. On the one hand, investment decisions are assumed to depend on the *current* (i.e. realized, "ex-post") rates of profit and/or utilization. The dependence of h^i on current r and u would seem to involve circular reasoning, if viewed in the context of the present interpretation: in order to determine the current (i.e. equilibrium) values of u and r we need an investment function, which in its turn depends on the current values of u and r[53]. On the other hand, Rowthorn states explicitly

[52] This interpretation seems to be very close to the one provided by Keynes in his *General Theory*, even though with reference to a more general context of economic growth.

[53] As is clear, this circularity would disappear if we took the desired rate of accumulation as given (i.e., not dependent on current u and r).

that "the economy *always lies on the profits curve,* for this simply indicates the relation between output and costs at any given level of capacity utilization"[54].

In reality, the authors seem to adopt an analytical scheme which is reminiscent of Kalecki's[55]. Time is divided into unit periods; at the beginning of period t, a certain amount of investment decisions is taken, given the values of u and r in period $t-1$ and given the existing capital. Since it is assumed that these decisions are always realized, they will coincide with the current investment activity, here indicated by h_t.

Within the period, through the working of the Multiplier mechanism, the investment activity determines the current (i.e. realized) utilization degree u_t and hence the current rate of profit r_t, given the real wage rate and production techniques. In turn, u_t and r_t determine the amount of investment decisions relative to capital taken in period $t+1$, and so forth[56]. The convergence process can be illustrated with the help of the previous diagram, which is now viewed in a new light.

Suppose that in the initial period the current accumulation rate is equal to $h_0 = h_n$: then, in the same period u and r will settle at the

[54] Cf. R. ROWTHORN, *op. cit.,* p. 19. This statement is in contradiction with another passage in Rowthorn, where he holds that "at points above the realization curve... savings exceed investment, there is excess supply of goods and *some profits cannot be realized*" (*Ibidem.,* p. 19).

[55] Cf. M. KALECKI, *Selected Essays in the Dynamics of the Capitalist Economy*, Cambridge, C.U.P., 1971. The analogy with Kalecki's work, however, is not complete, as Kalecki did *not* focus his attention on the steady-state solutions of his models, considered as economically irrelevant.

[56] Therefore, we should write:

$$h_t = \alpha + \beta\, u_{t-1} \qquad [A2.1]$$

where h_t is the investment activity at the beginning of period t and u_{t-1} is the utilization rate prevailing in period $t-1$. u_{t-1} is obtained by equating h_{t-1} to the saving function [3'] and solving for u, which yields:

$$u_{t-1} = (h_{t-1} + s_k\,\delta)/s_k\,(m/k). \qquad [A2.2]$$

Substituting [A2.2] for u_t into [A2.1] gives:

$$h_t = [\alpha + \beta\delta\,(k/m)] + (\beta k/s_k m)\,h_{t-1}. \qquad [A2.3]$$

In this way, we get a first-order linear difference equation, which expresses the dynamic behaviour of the accumulation rate. Since the relation between h and u is linear (as well as that between u and r), it is possible to derive similar expressions for the associated behaviour of the current rates of utilization and profit:

$$u_t = [(\alpha + s_k\delta)\,(k/s_k m)] + (\beta k/s_k m)\,u_{t-1} \qquad [A2.4]$$

$$r_t = [\alpha/s_k + \beta\delta\,(k/s_k m)] + (\beta k/s_k m)\,r_{t-1}. \qquad [A2.5]$$

The solutions of these difference equations are, respectively [cf., for example, G. GALDOLFO, *Economic Dynamics: Methods and Models*, North-Holland, 1980 (2nd Ed.), pp. 14-23]:

$$h_t = A_h\,[\beta/s_k\,(m/k)]^t + \{s_k\,[\alpha\,(m/k) + \beta\delta] / [s_k\,(m/k) - \beta]\} \qquad [A2.3']$$

$$u_t = A_u\,[\beta/s_k\,(m/k)]^t + \{(\alpha + s_k\delta) / [s_k\,(m/k) - \beta]\} \qquad [A2.4']$$

$$r_t = A_u\,[\beta/s_k\,(m/k)]^t + \{[\alpha\,(m/k) + \beta\delta] / [s_k\,(m/k) - \beta]\} \qquad [A2.5']$$

where A_h, A_u, A_r are arbitrary constants such that $A_u = A_h\,(k/s_k m)$ and $A_r = A_h\,(1/s_k)$. Note that the last terms on the right hand side correspond to the equilibrium values previously determined: cf., respectively, equations [Eh], [Eu], [Er] in note 11. The convergence to these values will obtain if the term to the power of t is less than unity, i.e. if the stability condition [5] holds.

levels $u_0 = u_n$ and $r_0 = r_n$, while the desired accumulation rate will be $h_0^i = h_1$. Therefore, in period 1 the current investment activity will be h_1 and u and r will settle at the new levels u_1 and r_1: such a process will go on until point E is *reached*, where the tendencies to change become exhausted. In this sense, point E can be thought of as expressing "conditions of tranquillity". Notice that, as the economy follows the path indicated in the diagram, it will be moving *on* the curves r_t, h_t, and h_{t+1}.

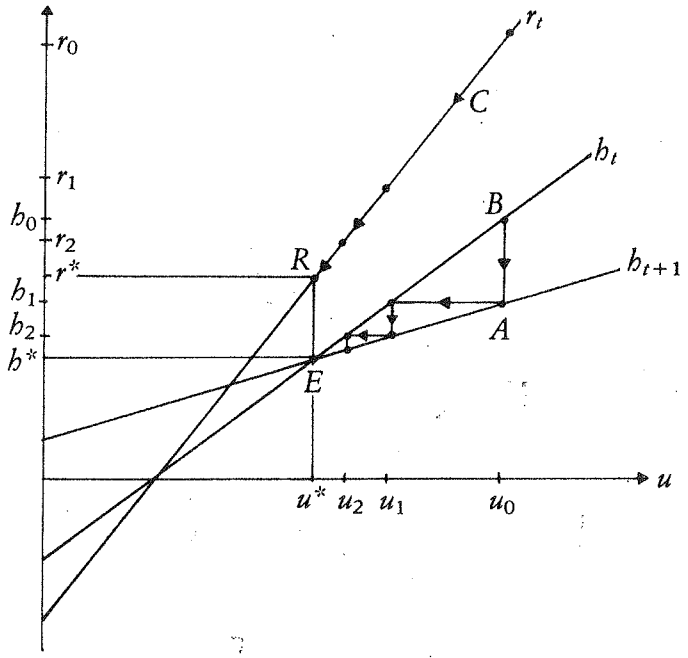

Fig. 3a. Stability of the steady-state equilibrium.