

# The Composition of Investment under Conditions of Non Uniform Changes\*

## 1. - Introduction

1.1 This paper will discuss Professor Adolph Lowe's analysis of an economy subject to discontinuous changes, in relation to some aspects of the works by Maurice Dobb and Michal Kalecki on socialist planning.

The main thrust of the argument will be directed towards the implications of looking at production as a process involving specificity of equipment and complementarity between the latter and the labour force actually employed. Both phenomena arise whenever output is governed by what Marx called an organised system of machinery. The production of machines by means of machines tends to establish a definite technical relation between them; their non-malleable physical character is the source of non-smooth changes which reflect themselves also in the composition of the work force.

Central planning appears in Dobb's studies on developing economies as the main instrument to overcome the stifling effect on investment caused by indivisibilities in capital equipment, without at the same time losing control on sectoral proportions. His observations will be integrated with Meir Merhav's concept of technological dependence, which explicitly takes into account the functional role of imports. The discussion, to be carried out in the next section, will also point at the different, but not less important impact of factors complementary and specificity in a mature economy. Use will be made of a pioneering paper by Nicholas Kaldor in

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which he argues that instability stems from maladjustments between machinery and labour, thus creating the conditions for state intervention.

1.2 In many respects Lowe's model encompasses and supersedes those of Dobb and Kalecki because it provides an unambiguous definition of the structural composition of investment. The capital goods sector is divided into two branches: one, called machine tools sector, generates equipment for its own expansion as well as for the second branch which produces machinery to be allocated only in the consumption goods sector. No homogeneity between the outputs of the two equipment sectors exists; whereas in conventional two sector models heterogeneity is confined to the difference between capital and consumption goods.

The third section will discuss Dobb's and Kalecki's contributions in the light of Lowe's. Dobb did in fact use an earlier version of Lowe's scheme without, however, following its dynamic implications. Finally, the last section will analyse, on the basis of the model suggested in the third one, the possibility of excess capacity and deficiency of capital which can arise also in a planned economy when the system moves from a higher to a lower growth rate.<sup>1</sup>

## 2. - Observations on the Specificity of Equipment in Developing and Mature Economies

2.1 At any one time, the technical basis of the economy conditions the forms in which the economic surplus can be utilised. But a developing economy faces the task and the problem of investing in a manner largely independent of the pre-existing material

<sup>1</sup> The main references for the analysis of the structure of investment will be: LOWE (1976) especially chs. 13, 18, 22; DOBB (1960), MERHAV (1969) and KALECKI (1972) ch. 11. Dobb and Merhav used an early version of Lowe's model, LOWE (1955). Models similar to Lowe's were also developed by RAJ and SEN (1961) and by NAQVI (1963). They did not, however, explicitly deal with changes in intersectoral proportions. Starting from a situation of scarcity of equipment they deal rather with where to allocate a given amount of imported capital goods. Kaldor's paper referred to above appeared in 1938 and was reprinted in KALDOR (1960).

structure. To the extent to which such an operation is possible, indivisibilities in equipment, which "are likely to be significantly large (relatively to the scale of the economy) at early stages of development",<sup>2</sup> may make the expansion of a certain branch unprofitable although its growth can be of crucial importance for the formation of other industries. Planning performs the role of removing the obstacles imposed by the rigidity of fixed capital and of securing, overtime, the construction of complementary industries.<sup>3</sup> The concrete mechanism which initiates the "take off" has been called by Dobb the *Accelerator in Reverse*, because it presupposes the production of capital goods well in advance of any market demand for them.

Since the emphasis is here on the *longue durée* of capital formation, a necessary aspect of industrialization, the rationale is the same as that given by Schumpeter in *Capitalism, Socialism and Democracy*, who maintained that a system which does not use its resources optimally at a given point in time may display a long run performance superior to a system obeying the optimality criteria.<sup>4</sup>

Dobb's main frame of reference was the USSR. This country inherited from the Tsarist regime a deficient but not altogether negligible industrial sector including machine tools factories, which are of primary importance to the activation of the *Accelerator in Reverse*. Many poor countries do not have, however, the possibility of transforming their savings into a type of investment capable

<sup>2</sup> DOBB (1960), pp. 11-12.

<sup>3</sup> Oscar Lange gave a very clear definition of the scope of planning: "For planning economic development long term investments have to be taken out of the market mechanism and based on judgement of developmental economic policy. This is because present prices reflect present data whereas investment changes data by creating new incomes..." and: "In other words, investment changes the conditions of supply and demand which determine equilibrium prices." LANGE (1969) p. 160.

It is therefore possible to say that market signals represent responses to past decisions about investment, which in the meantime materialised in a given quantity of non-malleable capital goods.

<sup>4</sup> In the presence of exhaustible resources technical progress should lead, in the course of time, to a more economical use of them. If this does not take place, the amount of capital equipment, which in the future will be allocated to discover and exploit new deposits, will have to be larger than expected. Technical progress is necessary even to maintain the stationary state. To extract from year to year a given quantity of minerals rising quantities of equipment will have to be enlisted if technical change is zero. See on this point LOWE (1976), chs. 19, 20, 26.

of triggering a process of sustained growth.<sup>5</sup> This structural inability to supply capital goods, which must then be imported, is what Merhav termed technological dependence. In Merhav's analysis development in an open economy strengthens the role of the capital goods sector, because trade takes place between two fundamentally different entities. On one hand, we have the advanced economy which, through its machine tools industry, can generate technical progress, change the type of machinery and thus choose, to a large extent, its degree and field of specialisation in a dynamic sense. On the other hand, we have the backward economy for which no such spectrum of endogenous choices is available.<sup>6</sup>

The exports going to finance imports of capital goods must be such as to expand the import capacity of the country.<sup>7</sup> The adaptation of investment to the changing export requirements can lead, in the absence of long term agreements, to a composition of equipment divorced from the needs and goals of national socio-economic development. It should be noticed that, when equipment is specific, any significant modification in its distribution involves a process of formation and liquidation of capital, which is all the more painful and wasteful in a developing country. Under conditions of technological dependence Dobb's *Accelerator* appears to be much more unstable due to the enormous difficulties of planning the proportionality between one (poor) country's output and that of the rest of the world.

The undiminished role of the capital goods industry is emphasised also in those writings where machinery is imported as a gift. If the purpose is to achieve full employment and balanced growth, the allocation decisions follow very closely Dobb's mechanism for a closed economy. The difference consists in the fact that the

<sup>5</sup> As it appears from the ILO study on rural poverty. ILO (1977).

<sup>6</sup> According to Professor K.N. Raj the development of a machine tools sector in China, made possible also by the type of her trade with the USSR, was an important factor in the repayment of her debts with the Soviet Union and in overcoming shortages of foreign currency. RAJ (1969).

<sup>7</sup> In Merhav's study the import dependence of investment is at the roots of lopsided development. The demand for capital equipment stemming from the domestic sector is constrained by export earnings. At the same time the level of investment in the export sector is largely independent of the level of demand in the domestic sector. In a situation where the two sectors are not complementary to each other the link between them can be that of competition for factors in the home market. See MERHAV (1969) chs. 1 and 5.

acquisition of gifts reduces the pressure on consumption and actually creates the technical basis for the conversion of savings into productive capacity.<sup>8</sup>

2.2 Dobb's analysis of the indivisibilities in capital accumulation and their necessary connection with planning has become a milestone for the theory of economic development.

A totally different picture emerges when we come to the interpretation of adjustment processes in mature capitalist societies. It is generally assumed, as in ISLM macroeconomic models, that with perfect market flexibility the economic system would quickly find its full employment level of output.

Now it is true that developed countries do not face the structural limits in the production of equipment goods mentioned before. Yet, as Paul Baran pointed out, the problem facing the policy makers and managers "would be not slow adjustments to small changes — the main pre-requisite for the applicability of the rules derived from static analysis — but choice among few technological alternatives involving large indivisibilities and 'fixed coefficients'."<sup>9</sup> Also the advanced economy is subject to the discontinuities which occur whenever growth factors change.

The implications, for state intervention, of the structural characteristics of economic activity, were lucidly grasped by Kaldor in the essay published in 1938. Although his propositions were not intended to elucidate the rationale of a socialist system, they can be of use in placing Kalecki's views on central planning in the context of a mature economy.

Kaldor's argument is based on a sharp distinction between disequilibrium in savings and investment in the short run, and maladjustment between equipment and labour which may arise in

<sup>8</sup> Lionel Stoleru produced a two sector fixed coefficients optimal control model which incorporates Dobb's *Accelerator in Reverse*. He applied it to Algeria with two objectives: full employment balanced growth and production of consumer goods. It came out that with a 3 to 4 ratio of foreign aid to the initial domestic output of capital goods, to achieve full employment per capita consumption would have had to fall initially by 28 per cent, without foreign aid by 65 per cent. The introduction of foreign aid did not affect the pattern of allocation of equipment; the authorities remained in full control of the distribution of capital goods. The merit of the exercise lies in showing, by implication, the degree of leeway that must be given to many ex-colonial countries to develop. See STOLERU (1965).

<sup>9</sup> BARAN (1969), p. 147.

the longer run. For the purposes of this paper the problem will be presented in the following way.

Let us assume an economy with two vertically integrated sectors, capital and consumption goods, operating below full capacity, it is also assumed that wage earners do not save. At any one time the value of output of each sector is equal to the respective wage bills multiplied by the markups. The difference between the value of output and the wage bill gives the level of profits in each sector. The sum of profits multiplied by the propensity to save out of profits determines the level of savings, which in turn are equal to investment and therefore to the value of capital goods.

An excess of savings over investment arises when full employment in the investment sector has a multiplier effect which, given the money wage, the markups and the propensity to save, leaves the consumption sector below its full capacity-full employment level. The reverse takes place when investment exceeds savings: to full employment in the consumption industries there corresponds unused capacity in the equipment producing industries. Both situations can be remedied in the short run by measures affecting the distribution of income: in favour of wages in the first case and in favour of profits in the second.

An advanced economy can be characterised as one in which, even in the short run, the employment capacity of existing capital stock can absorb the existing labour force under conditions of full capacity. It therefore follows that, for a given distribution of equipment between various sectors, a real possibility exists for the employment capacity of newly produced machines to exceed the increment in labour supply. Technical progress will not necessarily induce entrepreneurs to scrap old equipment in favour of the new. Old equipment will remain in use as long as the direct cost per unit of output is less than the total cost per unit of output produced by the new.

To avoid the persistence over time of the disequilibrium between capital and labour, a significant shift would be required in favour of investment goods allocated in the consumption goods sector. In a situation where equipment is specific, the adjustment process cannot be secured exclusively by the fall in prices of capital goods. As Lowe pointed out, such a price fall would create a deflationary spiral within the equipment industries which would per-

petuate the excess supply conditions.<sup>10</sup> From the viewpoint of entrepreneurs operating in these industries the problem becomes how to stop a continuing deflation in capital values and prices. The logical step is to cut investment giving rise to a downward multiplier effect. Thus, as Kaldor put it: "Once redundant capacity appears it will be almost impossible to maintain activity undiminished, unless state investment activity is extended so wide as to replace private investment."<sup>11</sup>

According to Kalecki the mechanism of the multiplier, both upward and downward, is a central macro-economic aspect of an oligopolistic mature capitalist economy. A completely different mechanism is at work in a socialist economy. "In order to bring into focus the nature of this process [i.e. of the multiplier] in the capitalist economy it is useful to consider what the effect of a reduction in investment in a socialist economy would be. The workers released from the production of investment goods would be employed in the consumption goods industries. The increased supply of these goods would be absorbed by means of a reduction in their prices. Since profits of the socialist industries would be equal to investment, prices would have to be reduced to the point where the decline in profits would be equal to the fall in the value of investment. In other words, full employment would be maintained through the reduction of prices in relation to costs."<sup>12</sup>

The level of activity is in this case tied to the amount of available productive capacity; and the change in prices relatively to wages corresponds to planned changes in the allocation of capital goods. Indeed for Kalecki the *differentia specifica* of a centrally planned economy lies in the fact that the price/wage relation can be fixed and modified by the planning authorities in accordance with the rate of accumulation. This immediately raises the question about the possible obstacles to a successful transition from one growth rate to another.

<sup>10</sup> This is also the view of trade cycle theorists who explained crises in terms of over-capitalization. BOUNIATAN (1928).

<sup>11</sup> KALDOR (1960), p. 115.

<sup>12</sup> KALECKI (1971), p. 97.

### 3. - A Comparison Between Lowe's Model and Those of Dobb and Kalecki

3.1 A close look at the above quotation reveals that Kalecki based his preference for central planning not on the assumption of a permanent priority in the capital goods sector, but on the consideration that a socialist economy can adjust to a lower rate of accumulation and growth without being entangled in a downward multiplier process. Priority in the investment sector is not denied. It is seen rather as a temporary measure to raise the growth rate and to absorb labour reserves. Shifts from investment to consumption or vice versa are themselves the outcome of movements within the capital goods sector. Structural transformations in the latter provide the key to whether or not an 'efficient' adjustment is possible. It is at this point that Lowe's model can be inserted.

Consider an economic system whose productive activities are split into three sectors: consumption goods C, investments goods I, which are produced only for replacement and expansion of capital stock in the C sector, machine tools X, which are allocated in the X sector as well as in the intermediate sector I. The machine tools department performs, therefore, a genuine role of reproduction and self reproduction, displaying a dynamics of its own. In this way we have two sectors X, and I, whose capital inputs are homogeneous, so that shiftability in capital stock between them can be assumed. The I sector, produces equipment which is an input only for the consumption sector, which means that capital stock in the latter is non-transferable. It is easy to see that this scheme combines transferability with specificity. In two sector models, by contrast, only two extremes are possible, either complete flexibility or complete rigidity, both at the expense of the internal dynamics of the equipment industries.

Using the traditional notation of K for capital stock, the subscripts x, i, c for the respective sectors and calling u the proportional depreciation coefficient, n the uniform share of consumption in each of the three sectors, we have in constant prices:

$$(1) X = u(K_x + K_i) + \Delta K_x + \Delta K_i$$

$$(2) I = u K_c + \Delta K_c$$

$$(3) C = n(X + I + C)$$

The first two equations simply state what has just been said in words. Eq. (3), which will no longer appear in our discussion, helps us understand the exchange conditions between capital and consumption goods. Writing  $S_c$  and  $S_i$  for savings (= investment) in the respective sectors, and remembering that the whole output I becomes investment in the C sector, we get from (3):

$$(4) S_c = I = (1 - n)C = nX + nI$$

thus: recalling that gross investment in I is the value of machinery received from X:

$$(5) I(1 - n) = nX = S_i = I_i \text{ where } I_i = \text{investment in the I sector.}$$

On the assumption that all profits are saved and all wages consumed, eq. (4) asserts that the amount of capital goods sold from the I to the C sector, must be exchanged with an amount of consumption goods equal to the value of the wage bills of the two equipment industries. Equation (5) reveals that the amount of capital goods received by the I sector from the machine tools industry X must be exchanged with an amount of consumption goods equal to workers' consumption in the X sector. The affinity of equations (1) to (5) with Marx's schemes of reproduction is very clear, although there is an important modification: in Marx's two sector model each department gets a certain amount of goods from the other, while in Lowe's construction no part of the I sector output goes to X. Profits in the former have to be entirely realised in selling to C then spent to purchase goods from X, as shown in the equilibrium relation (5).

When the system grows at a uniform rate g the proportion between I and X will correspond, *ceteris paribus*, to  $\frac{K_i}{K_x} = q$  multiplied by the ratio of the respective output capital coefficients, which, for simplicity, we assume to coincide. Expressing  $K_x$  in terms of X multiplied by its capital output ratio, substituting  $qK_x$  for  $K_i$ , solving for g and differentiating with respect to q we get:

$$(6) \frac{dg}{dq} < 0; \text{ i.e. changes in the growth rate are negatively}$$

related to changes in  $K_i/K_x$  and therefore to the proportion of X output going to the I sector.<sup>13</sup>

<sup>13</sup> Relation (6) is derived from:  $X = m(1+q)(u+g)X$ , which is then solved for g and differentiated with respect to q. m is the capital output ratio. It is assumed, as Lowe does, that the capital output ratio is uniform. The capital labour

The ratio between consumption and aggregate gross investment is in turn positively related to  $q$  and indeed in the simple case of uniform capital coefficients  $C/(X+I)$  is identical to  $q$ . Since  $I$  is gross investment in the consumption sector, an increase in  $q$  will raise the ratio between capital stock in the consumption sector and the sum of the capital stocks in the two equipment sectors. It follows that the contradiction between consumption and accumulation manifests and exhausts itself in the proportion between the two departments producing means of production.

It appears from the above model that there is a qualitative priority of the machine tools sector but not necessarily a quantitative one. The need to assign such a quantitative supremacy will depend on the phase in which the economy finds itself, a question to which we shall return in the next section.

To grasp the relevance of the tripartite scheme let us briefly discuss a special but not unrealistic case of accelerated accumulation involving induced starvation of a part of capital stock.

'Induced starvation' occurs when the maximum investment effort is put into the machine tool sector at the expense of total investment in the rest of the economy. On the assumption that  $K_c$  and  $K_i$  are homogeneous, so that  $K_i$  can be shifted to produce  $X$ , this would mean that capital stock in the consumption sector, which is not transferable, ceases altogether to receive replacement equipment. Disregarding the drastic effects on consumption caused by the depletion of  $K_c$  under conditions of an increase in employment and investment — an increase due to the self-reproduction of the  $X$  sector — this policy is feasible only in so far as the size of capital stock is non-negligible. An economy with a very limited machine tools industry falls within the boundaries of Merhav's notion of technological dependence. The structural incapacity to supply machine tools prevents a rise in the saving ratio from being fully transformed into an increase in the investment ratio.<sup>14</sup>

ratio is also treated by Lowe as uniform and non malleable. This assumption is retained in our paper. In Chapter 13 of Lowe (1976) variability in capital labour ratios is introduced in order to show that it does not eliminate structural discontinuities.

<sup>14</sup> Studies on the industrialization of the USSR seem to support the hypothesis that 'induced starvation' did to some extent take place. See ERlich (1960, 1978), Vyas (1979). Vyas's work relies on recent analyses by Soviet scholars.

3.2 Michal Kalecki came very close to a similar formulation of the dynamics of investment. Chapter 11 of his *Essays on the Economic Growth of the Socialist and the Mixed Economy* is titled "The Structure of Investment." It is a model where investment in the capital goods industries is singled out from aggregate investment. It centres on the following two equations

$$(a) \quad g = \alpha i - u; \quad (b) \quad g_k = \beta \cdot k - u$$

where  $g$  and  $g_k$  are the growth rates in the whole economy and in the capital goods sector.

$i = I/Y$  = share of gross investment in national income.

$k = I_k/I$  = share of investment allocated in the capital goods sector.

$\alpha$  and  $\beta$  the aggregate output capital ratio and output capital ratio in the capital goods sector.

$u$  is the uniform depreciation rate.

When  $k$  increases  $\alpha$  tends to  $\beta$ .

Subtracting (a) from (b) and solving for  $k$  we get:

$$(c) \quad k = \frac{\alpha}{\beta} i + \frac{1}{\beta} (g_k - g)$$

When the economy expands at a uniform rate,  $g_k - g = 0$  and  $k = \frac{\alpha}{\beta} i$ . If a decision is taken to raise the growth rate, the share of investment must be increased as well, which means that the new equilibrium value of  $k$  will also be higher. Yet to raise  $g$  it is necessary all things being equal, to increase  $g_k$  first, since accumulation in capital goods industries pulls up the capital stock of the whole economy. Thus, there will be a transitional period where  $g_k > g$ , entailing an intermediate value of  $k$  greater than the terminal one when the economy will be growing at a new higher uniform rate. As a consequence, while approaching the new equilibrium growth rate, the pressure on capital goods industries must be reduced.

In the context of the actual experience of the Eastern European socialist countries Kalecki's exercise serves as an important warning against the bias towards rising accumulation rates. From a theoretical point of view, however, Kalecki's approach is subject to the same criticism levied against the inability of two sector models to take

into proper account the structural transformations operating within the investment sector itself.

To be sure Kalecki was aware of such a limitation and reformulated the expression for  $k$ , eq. (c), to account for either a certain degree of shiftability (transfer of machinery from consumption to investment good industries) and/or a favourable change in the structure of foreign trade (increase in imports of machinery at the expense of consumption goods).

$$(d) k^* = \frac{\alpha}{\beta} i + \frac{1}{\beta} (1-T)(g_k - g); \text{ thus } k^* < k$$

where  $T$  = coefficient of shiftability of machines.

Eq. (d) says that the share of aggregate investment can be now increased by utilising, for the purpose of producing capital goods, machinery installed in the consumption sector. This means that the share of investment going to the capital goods sector is, for a given  $(g_k - g)$ , smaller than that required if  $T$  were zero.

In a simple two sector model the meaningfulness of the coefficient of transferability  $T$  depends very much on the implicit assumptions about the different lengths in the construction period of capital equipment. No hidden assumptions are needed in a Lowe type model in which the period of construction is uniform and it is equal to one year. In equations (1) and (2) the coefficient  $T$  applies only to the capital stock operating in the I and X sectors. The value of the coefficient can be fixed at such a level that the reduced  $K_i$  generates an output still in excess of replacement requirements in the consumption goods sector, whose output therefore will not fall in absolute terms.

If we now apply the same reasoning and the same assumptions to a two sector model, transferability acquires an unambiguous meaning when it coincides with 'induced starvation.' When reinvestment in the capital goods sector of its own total output does not suffice to meet the planned difference  $(g_k - g)$  part of consumption goods equipment will have to be shifted. Consumption goods output will fall as a result of the combined effect of non-replacement and of the transfer of machinery.

It is easy to see therefore that, in order to take into minimal account such complex, and by no means smooth effects of investment activity, it is necessary to introduce at least one diversification in the capital goods sector.

3.3 Throughout his book *An Essay on Economic Growth and Planning*, Maurice Dobb made an explicit and extensive use of Lowe's 1955 version of the three department scheme, thus recognising its importance for the theory of socialist planning.

Several questions can be raised, however, as to whether Dobb's use of the structural approach was appropriate relatively to its explanatory power vis à vis the problem of specificity in capital goods production.

Dobb's reasoning contains two lines of thought. One is concerned with how to expand investment when the supply of wage goods is limited on the assumption that the surplus of labour cannot lower the industrial wage below a certain socially given level. The second deals with the connection between the rate of investment and the productive capacity of the stock of capital in the equipment sector.

It is clear that the latter case can be most suitably analysed in terms of our three sector model, whereas Dobb carries out the discussion on the basis of the simple two sector scheme. Observations about the impediments that could arise during the process of accumulation are confined to general remarks on the ceiling of the share of investment in capital goods industries over total investment as well as on the negative impact on consumption resulting from a continuous increase in that share.

By contrast, and rather surprisingly, Dobb uses Lowe's work, with an important change, to discuss the first case which is a problem of choice of techniques. Dobb modifies the model by expressing the three sectors in terms of the distribution of the labour force, rather than that of the respective capital stocks which are assumed to last forever. If the supply of wage goods (and the number of workers producing them) is given, the expansion of investment, with the aim of increasing wage goods output in the immediate future, cannot be implemented by shifting workers from consumption to investment activities. Instead it would be necessary to move workers from the I to the X sector along with the choice of a technique of production whose capital intensity maximises the growth rate. The model works on the assumption that production lags are negligible and that capital goods produced in the past are malleable.<sup>15</sup>

<sup>15</sup> See SEN (1960), Appendix to ch. 3.



This approach tends to obfuscate the real significance of the structural interdependencies under conditions of input specificity.

The shortcomings of Dobb's approach become evident when the objective is no longer to increase wage goods supply in the short run but, rather, to put all the investment effort into the expansion of the X sector. He writes: "In this way all the labour available to the investment sector will be progressively drawn into [the X sector] and concentrated there in using machine-tools of a cheaper type but inferior productivity to produce more expensive types of much higher productivity."<sup>16</sup> The main issue here is not the choice of techniques, rather it is one of structural proportions. More specifically the central question is what happens to replacement requirements in the consumption sector when the workforce in the I sector (which produces equipment for C) moves to the production of machine tools. The answer is 'induced starvation' of capital equipment in the consumption industries. The analysis must therefore focus on the limits to 'induced starvation' because, as equipment in the C sector shrinks, so will its labour force, violating Dobb's assumption that it should not change. Such an assumption is possible only if capital goods last for ever. But this hypothesis *de facto* reduces the role of structural constraints and runs against Dobb's correct observation that intersectoral relationships should be of primary preoccupation of any planned economy. This dichotomy arises from the use of a model axed on bottlenecks and discontinuities for a purpose, (choice of techniques) where the analytical apparatus plays down the existence of rigidities.

#### 4. - The Transition to a Lower Growth Rate

4.1 In this section we shall analyse the shifts that must occur in the composition of capital equipment when growth rates fall, which amounts to discussing in greater detail the effects of a fall in investment (or in its share) pointed out by Kalecki in the passage quoted at the end of the second section. It is also hoped that the discussion of the structural discontinuities that accompany the downward adjustment process will contribute in the direction

<sup>16</sup> DOBB (1960), p. 61.

suggested by Dobb in 1967, partly as a result of a critical evaluation of the investment policies followed by most socialist countries.<sup>17</sup> The view advanced by Dobb consists of a multi stage theory of growth for a socialist economy: after having experienced a phase characterised by investment priority in heavy industry, the economy should enter a phase where either the share of accumulation is stabilised, or it is reduced in favour of consumption only to be stabilised later to prevent a continuous decline in the growth rate.

The perspective rate of change in the supply of labour will determine, in the main, which of the two variants is chosen. Let us therefore proceed on the same simple assumption made by Lowe: a given equilibrium growth rate can no longer be maintained because of a fall in the rate at which the workforce expands.

4.2 Other things being equal this will generate a glut in capital equipment similar to the case of maladjustment referred to by Kaldor. Such a glut will appear in the equipment for the production of consumption goods if the structural shifts take place in anticipation of a lower growth rate; whereas it will appear in the machine tools sector if the shifts occur *ex post factum*. The second possibility has been extensively discussed by the author in chapter 18 of the *Path of Economic Growth*; here we shall analyse the first form of over-production of machinery.

In order to steer the economy towards the expected lower growth rate it is necessary to reshuffle the stock of capital sometime in advance. But this is possible only between  $K_x$  and  $K_1$ , the stocks in the two equipment sectors, since  $K_c$  is heterogeneous vis à vis the rest. The percentage change of  $q$  which will bring the  $K_1/K_x$  ratio to the level corresponding to the new growth rate, is for non-infinitesimal discrete variations:

$$(7) \frac{\Delta q}{q} = \frac{1}{H} \left[ \frac{-(\pm \Delta g)}{1 - m(g+u)} \right];$$

$$\text{from } q = \frac{1 - m(g+u)}{m(g+u)}$$

$$\text{where } H = (g+u \pm \Delta g)$$

In Lowe's scheme the change in  $q$  is possible in advance of the actual decline in  $g$  without disequilibrating the economy rela-

<sup>17</sup> DOBB (1967).



tively to the current  $g$ . Suppose that the reduction in the growth rate of the labour force is expected to manifest itself at the beginning of  $(t+1)$ . The adjustment in  $K_1/K_x$  can take place already at the beginning of  $(t-1)$  without any prejudice to the equilibrium between capital and labour when this is still growing at the old rate. In fact, on Lowe's assumption of uniform capital output ratio, the percentage increment in total capital from  $(t-1)$  to  $(t)$  remains unaltered. It is the capital stock in the consumption sector which will increase above average. The ratio between output  $I$  and its recipient  $K_c$  is, from equation (2):  $\frac{I}{K_c} = (u+g)$ , so that if  $g$  falls  $\frac{I}{K_c}$  must also fall. But, in raising the value of  $q$ , as shown in equation (7) with a positive product of the signs, sector  $I$  has received, at the beginning of  $(t-1)$ , more equipment from the machine tools industry than would have been the case if the system expanded at the previous value of  $q$ . As a consequence  $\frac{I}{K_c}$  will be greater than the old  $(u+g)$  and *a fortiori* greater than the new one. Thus given the actual values of the coefficients and of  $q$  the  $I/K_c$  ratio moves in a direction opposite to the one required for terminal balanced proportions. The glut in machinery for consumption goods originates from this situation.

As noted above from  $(t-1)$  to  $(t)$  capital will have expanded in line with the increase in the labour force, only its internal composition will have changed. Total equipment secures full employment with a higher proportion of machines and labour employed in the consumption sector. Consumers' goods prices will be reduced relatively to wages as envisaged by Kalecki. Over production of equipment is bound however to appear at the end of period  $(t)$ . This is because the  $\frac{I}{K_c}$  ratio will still be above the new equilibrium value. Capital stock in the two equipment sectors expands according to the new growth rate, but equipment made available to the consumption sector exceeds that rate.

At this point the authorities may give priority to the full utilisation of capital stock in the consumption sector, by hiring workers from the two departments producing means of production with the consequent formation of unused capacity there. Such kind

of options, and possibly further shifts from  $K_x$  to  $K_1$ , are open as long as the bulge in the  $\frac{I}{K_c}$  ratio causes total capital to increase more than labour. The limit to these options is given by the danger of what Lowe called capital dearth. The formation of unused capacity in the machine tools sector may reach a point where the latter is no longer capable of sustaining the expansion of capital stock in accordance with the new equilibrium growth rate. In this way despite the fact that transition to a lower growth rate implies abundance of capital, the structural outcome can be a deficit of equipment in the machine tools sector, which to be corrected requires a "backward switch" in the utilisation of labour and machinery. In the above context the role of the planning system is not to secure full capacity output at all costs but to regulate the distribution of unused capacities with the aim of maintaining full employment and preventing the possibility of capital dearth.

It should be noted that a two sector model, is in no position to depict the processes outlined hitherto. Any modification in the ratio between the stock of the single capital goods sector and the stock of the consumption goods sector affects immediately the expansion of total capital stock. In our case this would have led to a below equilibrium growth from  $(t-1)$  to  $(t)$  with the formation of unemployed labour. The restructuring of the proportions between the two sectors could have begun only in period  $(t)$ . If equipment is freely mobile the equilibrium ratio is *ipso facto* attained without over production of capital goods in the subsequent period. If only the gross output of capital goods is subject to allocation decisions a glut of machinery can emerge also in the two sector case. The model fails however to shed any light on the internal dynamics of investment.

4.3 The foregoing discussion suggests that also a planned economy will be subject to unused capacities when it moves to a lower growth rate. Its main problem is to avoid sliding into a situation of capital deficit without reacting by over-investing, which means sucking resources away from the consumption goods sector, with no future benefits because over-investment will lead to further maladjustments.

Professor Lowe's construction, in placing the long run implications of the formation and liquidation of real fixed capital at the

centre of economic analysis, has also highlighted the objective limits in the reliance on market signals as a guide for future action. In simpler words: if the information conveyed by the market can tell what is going wrong, it does not necessarily mean that it can tell what has to be done. The complex phases of structural modifications necessitate elements of control over the broad composition of investment and over the price wage relation.

In the context of a mature socialist economy the main issue is, we believe, not so much the dichotomy between the plan and the market, as the formation of an institutional set up flexible enough to allow for a decision-making process registering as much and as quickly as possible the changing objective conditions.<sup>18</sup> Kalecki reflected such an institutional framework in what he called the government's decision function which expresses the positive and negative evaluations leading to a decision about the planned growth rate. Clearly if the function is to be interpreted in a non-technocratic way (which *inter alia* is the only correct manner of interpretation), it presupposes the existence of bodies at different levels of the society where discussions about the overall and specific patterns of socio-economic development are an ongoing process.

As to the capitalist economy we have already seen in the second section how a disequilibrium between capital and labour may entail a deflationary spiral and a downward multiplier effect. A prolonged state of depression can in turn lead to a deficiency in capital equipment relatively to the long term requirements of the economy. But if the government intervenes just to keep up capital expenditure without bothering about its sectoral distribution it will create additional rigidities because capacity utilisation will be increased in a manner unrelated to the necessary shifts in the composition of capital.

4.4 By making the adjustment process a function of the supply of labour we have kept technical progress in the background. To introduce it explicitly would require an analysis of structural changes under different types of innovations and of their combined effects. Technical change reinforces the importance of the approach followed in this paper: an economy with zero innovations and zero

<sup>18</sup> Wrong reaction to objective conditions was the principal cause of a recession induced by over-investment, in Czechoslovakia in the early 60s. See GOLDMANN (1965)

population growth has no problems of structural shifts. But an economy with technical progress and zero population growth is permanently subject to modifications in the composition of capital equipment. The complexity of dealing with innovations stems from the fact that in a Lowe type model there is a structural lag between the appearance of an innovation and its absorption by the system as a whole. The process of absorption makes the analysis of the formation and liquidation of real capital even more relevant and emphasises its discontinuous character.

Sydney

JOSEPH HALEVI

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