MICHAL KALECKI

POLAND

ECONOMETRIC MODEL AND HISTORICAL MATERIALISM

THE ECONOMETRIC model and historical materialism constitute two different approaches to the development of a society. The former is based on functional relations between the econometric variables in the period considered as well as between these variables and the same variables in the past periods. The relations are assumed to be given and not subject to change. In this way a definite dynamic process is established which, however, corresponds to the actual developments only in the case where the basic assumption of the invariability of functional relationships referred to above is fulfilled.

Historical materialism considers the process of the development of a society as that of productive forces and productive relations (the base) which shape all the other social phenomena such as government, culture, science and technology etc. (the superstructure). There is a feedback effect involved here, the superstructure influencing the base as well.

The two approaches do not seem to be irreconcilable. After all Marx's schemes of reproduction are nothing else but simple econometric models. In fact in a special case where no changes in natural resources, productive relations and the superstructure affect the development of productive forces the system will follow the path determined by an econometric model because the condition of relationships between the economic variables not being subject to change is then fulfilled. In a more general case these functional relationships alter under the impact of events in three other spheres of the system and the economic development is then a much more complicated process than that presented by an econometric model as it reflects the evolution of the society in all the aspects.

The purpose of this paper is to inquire more thoroughly into the problem set out above in very general terms. We shall consider a closed system in order to be able to concentrate on the basic issues.

I

Let us denote the aggregate of variables characterising the economic situation of the system at the unit period t by B_t. Let us assume that the variables in question in that period may be represented as functions of these variables in the period t

and in the τ preceding unit periods. We may represent this symbolically as follows:

$$B_t = f/B_t, B_{t-1}, ..., B_{t-\tau}) \tag{1}$$

where f stands for the aggregate of relationships involved. B_t may be considered, as is fashionable nowadays, a vector which is a function of itself (i.e. some of its co-ordinates are interdependent) and of the vectors $B_{t-1}, ... B_{t-\tau}$ representing the economic situation in the past τ periods. τ is constant here, which is tantamount to the assumption that the variables of the periods more remote in time than the period $t-\tau$ have no direct influence upon the economic situation in the period t. Another basic assumption is the invariability of the function f, that is of all relationships for which it stands. If such is the case the above equation determines the course of the economic change for we have

$$B_{t+1} = f(B_{t+1}, B_t ... B_{t-\tau+1})$$
$$B_{t+2} = f(B_{t+2}, B_{t+1} ... B_{t-\tau+2})$$
$$\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots$$

the determination of B_t leading to that of B_{t+1}, the latter to that of B_{t+2} etc. This is the gist of the econometric model approach.

The crucial assumption of the invariability of f is rather far-reaching. For it presupposes that economic development determined by the above equation does not cause such transformation in the spheres of natural resources, productive relations of the superstructure that would in turn make for the change in the shape of the relationships between economic variables symbolized by f. In particular the abstraction of the interdependence between economic development and productive relations makes for the mechanistic character of the econometric model. This does not detract from its being a useful tool of analysis provided its limitations are kept in mind. What is, however, totally inadmissible is to construct an econometric model of future economic development postulating tacitly non-existent productive relations.

II

It should be noted that even in an econometric model the relationships represented by the function f cannot be considered strictly invariable. For the economic relations are by their very nature rather loose: the parameters involved are not strictly constants but constants plus some small random element. Thus the relationships between economic variables represented by f are quasi-invariable in the sense that they are subject to small random disturbances.

A question arises here whether the small random changes in the parameters lead to corresponding small changes in the economic variables in question or whether the effect is disproportionately large. We may call these two alternatives a stable and an unstable process respectively. In an unstable process a small change in the parameters results in the system's changing brusquely its path. This leads finally to a new stable process and it is this process that represents the actual development while the unstable process considered is ephemeral. For should it have ever existed

it would have been supplanted under the impact of random disturbances by the stable process referred to above[1].

Thus it may be postulated that relationships represented by the function f generated a stable dynamic process, i.e. that the character of these relationships prevents the generation of large changes in variables by small changes in the parameters involved. This quasi-invariability of f does not exclude by any means the existence of such a phenomenon as the business cycle. It means only that small changes in the parameters of the relationships between the economic variables will not in general affect considerably the course of the business cycle.

III

Let us now pass from the econometric model to the consideration of the development of the society in all the aspects. Let us denote the situation in natural resources, in productive relations and in the superstructure in the period t by A_t, C_t and D_t respectively. However, the situations C_t and D_t can be only partly described in quantitative concepts (such as the degree of concentration of wealth and income of the capitalist class); unmeasurable qualitative elements are involved here as well as contrasted with B_t which is an aggregate of quantitative variables. It should be noticed that B_t covers the sphere of productive forces and their effects.

The process generated by the econometric model may be denoted by $B \rightarrow B$ which indicates that this is an "autonomous" change in the sphere B. Correspondingly the autonomous developments in other spheres may be denoted by $A \rightarrow A$, $C \rightarrow C$ and $D \rightarrow D$. Of these $A \rightarrow A$ showing the "natural change" in the natural resources, although possibly significant in long periods (e.g. receding of the sea) is of no major interest and may be neglected in our analysis.

In addition to the "autonomous" processes there exist obviously interdependences between various spheres, e.g. the effect of economic development past and present upon productive relations and *vice versa*: $B \rightarrow C$ and $B \rightarrow A$. The significant interdependences are:

$$B \rightarrow A \quad \text{and} \quad A \rightarrow B$$
$$B \rightarrow C \quad \text{and} \quad C \rightarrow B$$
$$B \rightarrow D \quad \text{and} \quad D \rightarrow B$$
$$C \rightarrow D \quad \text{and} \quad D \rightarrow C$$

i.e. the effect of the economic development upon all other spheres and *vice versa* as well as the effect of changes in productive relations upon the superstructure and *vice versa*.

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[1] Cf. M. Kalecki, "Observations on the Theory of Growth", *Economic Journal*, March 1962.
It is theoretically possible that the unstable process does not lead to a stable one but that as a result of random disturbances the system is continuously subject to wild swings. Such a system, however, would be hardly viable and—to anticipate here the argument of subsequent sections—would have one way or another to undergo some institutional transformations which would put an end to its extreme instability.

Now the basic postulate of historical materialism is that autonomous changes in the superstructure are of lesser importance as compared with the effect upon it of economic development and changes in productive relations. Accepting this postulate we arrive at the following scheme of important connexions:

	A	B	C	D
A		×		
B	×	×	×	×
C		×	×	×
D		×	×	

the cross indicating the existence of cause and effect relation.

IV

Let us now go back to the problem of economic development (by which we mean the economic dynamic process including cyclical fluctuations) taking into consideration its interdependences with the evolution in the sphere of natural resources, productive relations and the superstructure. The economic development affects profoundly the state of natural resources (e.g. through exhaustion and discovery of mineral deposits), the productive relations and the superstructure. In addition productive relations are subject to endogenous change (e.g. development of class struggle within a given framework of economic conditions). Also their evolution has an important influence upon the superstructure.

The economic development in turn is under the impact of the changes in the three other spheres of the system. There will in particular exist a feedback relation here. The economic development e.g. causes changes in productive relations which in turn affect the course of the economic development.

It follows obviously that the basic assumption of the econometric model—that the function f which stands for all the relationships between economic variables present and past is not subject to change—cannot be maintained. The function undergoes a change from period to period determined by the influences $A \to B$, $C \to B$ and $D \to B$. Thus the equation (1) must be written now as follows:

$$B_t = f_t(B_t, B_{t-1}, \dots B_{t-\tau}) \tag{2}$$

This equation represents an econometric model only in the special case where f is invariable. This will happen under the following two conditions: (a) there are no autonomous changes in the spheres other than strictly economic conditions or if any they do not affect significantly the pattern of economic development; (b) there is no significant feedback effect involved in the impact of economic development upon the other spheres of the system.

V

In section II we discussed the problem of stability of the process generated in the econometric model by the function f. We came there to the conclusion that it is plausible to attribute to f the characteristic of giving rise to a stable dynamic process that will be not significantly dislodged from its path by a small change in f. In this case the small random changes in the shape of f which are always present do not create major disturbances in the evolution of the system.

There arises now the problem whether the function f, which in general undergoes a steady variation as a result of the influence of the evolution in the spheres of the natural resources, productive relations and the superstructure, exhibits this characteristic as well. Let us assume that f_n in the period n has this characteristic. As time goes by the shape of the function f changes and thus at some time $n+k$ it may alter to such an extent that it would not keep the system immune to small changes in f disturbing considerably the path of development. If this is the case small random changes in the shape of f_{n+k} will soon cause an abrupt dislocation in the economic development. Then as set out in section II the system would achieve soon a new stable path[2].

It may be therefore concluded that f_t is normally a function of such a type that small changes in its shape do not lead to major changes in the economic variables; but in certain critical periods which do not last long it may not exhibit this characteristic. In such periods the path of economic development will alter abruptly and sometimes the system may show for some period extreme instability of economic conditions.

VI

The abrupt changes in economic development discussed in the preceding section were caused by quasi-endogenous factors. It is true that the change in the shape of the function f from f_n to f_{n+k} resulted from the influence of the spheres A, C and D of the system. But the dislocation in the economic development came about because small random changes in f_{n+k} lead to large changes in economic variables. There may be, however, brusque deviations from the past path of development caused much more directly by the events in the spheres of productive relations and the superstructure.

In these spheres there will be frequently observed a phenomenon of certain issues coming gradually to a head to culminate in an explosion; such explosions shape up the pattern of the economic development by changing abruptly the function f.

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[2] It is theoretically possible that the system will be subject to wild swings (cf. footnote to p. 235). They would be, however, unlikely to last long because the inviability of the system would probably result in a reaction from the sphere of productive relations and that of superstructure which would put an end to the extreme instability.

The explosive processes in question and their causes may be different in character. Existing productive relations may hamper the economic development (which may read even to stagnation or retrogression); and the superstructure (form and composition of the government etc.) may not correspond even to that stage of productive relations that has been reached. This leads to a revolution in which both productive relations and the superstructure undergo a violent transformation. But the situation may also end in a reform and in such a case the transformation of productive relations and of the superstructure is much less far-reaching and spreads over a longer period. In either case the economic development will be profoundly affected but in a different manner.

Sometimes the reform caused by poor performance of the system may even not change basically the productive relations or the form and composition of the government. It may consist merely of implementation of government policies which, however, have an important bearing upon the economic dynamics of the system. To quote an example of a recent period: The Great Depression of the 'thirties shook capitalism to its foundations. What resulted from it, however, was merely a technique of government anti-slump intervention which barely scratched the surface of the capitalist system but nevertheless affected significantly the pattern of the business cycle.

CONCLUDING REMARKS

There emerges out of the above discussion a new way of presenting the evolution of society. The focal point of it is in a sense the economic development whose course is determined by a "generalized econometric model" which involves changing relationships between the economic variables present and past (see equation 2). These changes result from the impact of the evolution in the spheres of natural resources, productive relations and the superstructure, which is in turn profoundly affected by the course of economic development.