POLICY TARGET DYNAMICS
IN A GLOBAL-MODEL CONTEXT

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CONTENTS

Summary

This article's point of departure is the observation that global modelers characteristically do not justify their policy recommendations in terms of social optimal criteria. Instead, they simply compare the forecasts of their descriptive models with the simulations of their prescriptive models. This article attempts to clarify why social optimality criteria are necessary in global modeling and how such criteria can be constructed. In this vein, the socially optimal paths of policy targets are derived for a simple, illustrate global model.

Zusammenfassung

Der Ausgangspunkt dieses Artikels ist die Feststellung, daß die wirtschaftspolitischen Empfehlungen, die aus den heutigen Weltmodellen hervorgehen, nicht durch Optimalitätskriterien gerechtfertigt werden.
Statt dessen werden einfach die Vorhersagen deskriptiver Modelle mit den Simulationen preskriptiver Modelle verglichen. Dieser Artikel begründet die Notwendigkeit der Optimalitätskriterien in der Weltmodellierung und untersucht, wie diese Kriterien konstruiert sein können. An Hand eines einfachen Weltmodells werden optische Pfade wirtschaftspolitischer Zielsetzungen abgeleitet.

1. Introductory Remarks

Many long-term global models have indicated the need for steering the world economic, environmental, agricultural, and demographic systems towards a global steady state in which, at bare minimum, the world population's basic material requirements are satisfied. These requirements are usually defined in terms of the stocks of natural resources, capital goods, land, and pollutants as well as the flows of food, energy, and non-fool consumption goods. The need to achieve a global steady state is commonly suggested by the juxtaposition of descriptive and prescriptive global modeling efforts. The descriptive models attempt to picture how the world systems will evolve through time if the present-day economic, environmental, agricultural, and demographic policies are pursued. The prescriptive models embody an alternate set of policies which imply a different dynamic development of the world systems.

The juxtaposition of the descriptive and prescriptive modeling outcomes is meant to represent an implicit argument in favor of the policies which the global modelers advocate. Indeed, it is frequently self-evident that the world population's basic material requirements are more adequately satisfied under the prescriptive schemes than under their descriptive counterparts. Yet surely this line of argument is not really compelling. If the models can be accepted as accurate representations of reality and if it can be established that the prescriptive outcomes are more desirable than the descriptive ones, then all that follows is that the prescriptive policies are preferable to the current policies. It does not follow that the prescribed policies should be implemented, for it has not been shown that these policies are socially optimal (i.e. that these policies are preferable to any other feasible alternatives).

This is a matter of some importance, since the major global modelers are far from agreement on the global policies that are to be prescribed. Besides, the recommended policies of different modelers are frequently in conflict with one another. Yet even if the major modelers were in agreement or if their recommended policies were not mutually exclusive, it would still be helpful to know whether these policies are the best we can do, given our imperfect knowledge of world systems' dynamics. In case of disagreement, it would be helpful to have a set of criteria whereby the various policy alternatives could be evaluated.

This paper is an attempt to clarify why such criteria are necessary in global modeling and how they can be constructed. From a brief discussion of the major global models (which follows below), it emerges that global modelers have not, as yet, been concerned with the social optimality properties of their policy recommendations. This paper gives an account of analytical prerequisites which a global model should satisfy in order for the social value of different policies to be coherently assessed. Insofar as global models deal with the satisfaction of human material needs, one prerequisite is that specific policy targets with regard to resource depletion, pollution, population growth, capital accumulation, land use, etc. be formulated and that policy recommendations be described in terms of the temporal evolution of these targets. By means of a simple, illustrative global model, we show how socially optimal target paths may be chosen.

2. An Overview and Assessment

A glance at the major global models reveals that global modelers do not justify their policy recommendations by showing that they are preferable to all feasible policy alternatives. Instead, as we have noted above, they rely on a comparison between the forecasts of their descriptive models and the simulations of their prescriptive ones. Most of the descriptive global models predict an eventual leveling-off in economic activity and population. For some models, such as that of Kahn, Brown and Martel (1976), this leveling-off occurs once many of the basic human needs with regard to food, energy, natural resources, and environmental quality have been met (although pockets of poverty, particularly in the Indian subcontinent, may persist for a long time).

Yet for the predominant majority of descriptive models, the leveling-off is a socially undesirable phenomenon. In the studies of Forrester (1971) and Meadows et al. (1972), it comes in the form of "overshoot and collapse". Largely on account of lags in population and pollution dynamics, the growth of economic activity and the deterioration of the environment do not come to an end once the earth's environmental, agricultural, and resource carrying capacity has been reached. Consequently, catastrophes initiated by resource shortages, pollution, and land shortages and manifested in dramatic increases in death rates are predicted.

Whereas the models of Forrester and Meadows et al. suggest that the breakdown of economic activity and population is to occur within the next hundred years, the Ehrlichs (1970, 1971a, 1971b) argue that the collapse is already under way: the earth is already over-populated and ecological damage has already been done. Instead of making detailed predictions of how this situation will evolve in the future, they describe a number of instances in which our planet is failing to cope with industrialization, population, and pollution. Under present policy schemes, they expect these instances to multiply in the future.

According to Heilbronner (1974), the end of economic growth is presaged by "the descent of large portions of the underdeveloped world into a condition of steadily worsening social disorder, marked by shorter life expectancies, further stunting of physical and mental capacities, political apathy intermingled with riots and pillaging when crops fail" (p.24). The widening gap between rich and poor countries increases the likelihood of war (which represents a possible alternative to thermal collapse).

This gap is also the concern of Mesarovic and Pestel (1974), although these authors do not match Heilbronner's relentless fatalism. They point to the possibility of a sequence of regional collapses, beginning in the region they denoted as South and South East Asia, and spreading via the resource, food, and energy supplies which different countries share with one another.

Naturally, the predictions of these and other descriptive global models are contingent on the continuation of current economic, environmental, agricultural, and demographic policies. The prescriptive models, on the other hand, are driven by different policies which are designed to yield more favorable global steady states. The work of Kahn, Brown and Martel (1976) is an exception to this rule, since these authors consider the dynamic evolution of their descriptive model socially acceptable. Yet, for the most part, the policies prescribed by global modelers are quite at variance with those implemented nowadays.

Forrester (1971) and Meadows et al. (1972) each provide an ambitious shopping list of conditions whereby a global collapse may be avoided and a steady state may be attained in which (on average) the world population's basic material requirements are fulfilled. For example, the list of Meadows et al. includes a constant overall level of the capital stock, a one-shot increase in the average lifetime of capital equipment, a constant world population, a constant flow of food, a reduction in the use of natural resources per unit of output to one fourth is 1970 level, a reduction in the flow of pollutants per unit of output to one fourth its 1970 level, and a one-shot rise of agricultural capital relative to industrial capital (p.163-4). There is no discussion of whether these goals are attainable or, more fundamentally, whether these goals are preferable to other conceivalbe goals which also avoid collapse and lead to an acceptable steady state.

The Ehrlichs' (1970, 1971a, 1971b) desiderata are not specified with such precision, but there is a general call for "de-development" of industrialized countries, a dramatic redistribution of wealth from rich to poor countries (involving a transfer of 20% of the rich countries' national product over a period of 15 years), the "semi-development" of most under-developed countries and the abandonment of the rest, and the rapid adoption of a conservationist ethic (with the help of religious, educational, and legal institutions). Heilbronner (1974), for his part, points to the need for authoritarian regimes to cope with the economic, environmental, and political problems which he foresees. He also calls for a short-term redistribution of wealth and the adoption of relatively non-polluting technologies. The Ehrlichs and Heilbronner do not spell out the precise effects their recommended policies may be expected to have on food per capita, the stock of natural resources and pollutants, the production of energy and so on. They simply leave the impression that a more desirable state of the world could be achieved through their policies than through the current ones.

Mesarovic and Pestel (1974) argue that "organic growth" of the world system is necessary to avoid the regional collapses which they deem possible (p.196). This implies a world-wide synchronization of countries' growth rates and a coordination of their trade requirements. The global input-output study of Leontief et al (1976) is also concerned with wuch synchronization, as part of a scheme to reduce the income gap between rich and poor countires. It is shown how this goal may be served through a rapid expansion of world trade and an investment increase in poor countries.

The degree of desirable interdependence between rich and poor countries has been a subject of controversy in global modeling. At one end of the spectrum are the studies of Kaya et al. (1974) which call for a comprehensive international division of labor. At the other end lies the work of Herrera et al. (1976), which proposes that the basic material needs of people in given, well-defined regions be satisfied exclusively through the local resources of these regions. Tinbergen's study (1976), which not only emphasizes the desirability that poor countries become more self-reliant (particularly in the exploration and processing of their natural resources) but also articulates the need to develop industries in accordance with the principle of comparative advantage, probably occupies the middle ground in this controversy. It is difficult to evaluate the merits of these various global models and the associated policy recommendations, for nowhere are these recommendations justified in relation to their competing alternatives.

Some of the presecriptive global models above are represented in mathematical terms, while the others are described verbally. The models differ considerably from one another in terms of the representation of the world population's material requirements, the specified interrelations among the world's economic, environmental, agricultural, and demographic systems, and the degree of geographic and industrial aggregation. What all of these prescriptive models appear to have in common, however, is that they describe the transition to a global steady state resulting from a given set of recommended policies.

It is safe to say that most of the global models are capable of achieving more than on global steady state. The recommended steady state is simply one of many possibilities and global modelers characteristically do not justify their choice of a particular steady state over all other candidates. Furthermore, the transitional path leading to the global steady state is ususally not unique either. Here, too, global modelers have failed to show why their recommended transitional paths are preferable to the other feasible alternatives.

For several global models, such as those of Forrester (1971) and Meadows et al. (1972), the transitional path merely rests on a set of technological, sociological, and demographic prerequisites which may or may not be achievable. The practical means whereby these prerequisites can be met is simply not given consideration. In the words of Meadows et al, "We can say very little at this point about the practical, day-by-day steps that might be taken to reach a desirable, sustainable state of global equilibrium. Neither the world model nor our own thoughts have been developed in sufficient detail to understand all the implications of the transition from growth to equilibrium" (p.180).

Other global models describe the practical means whereby an acceptable steady state may be approached -- Spengler's taxes on population (1966), Heilbronner's authoritarian regimes (1974), Schumacher's reductions in the scale of technologies and organizations (1973), Ehrlichs' "de-development" of industrialized countries (1970) -- without a concrete description of how these practical means would be used to satisfy human needs. All too often global modelers advocate the use of new policy instruments and social institutions without clarifying what these innovations would imply for the production of food, energy and capital goods, and for resource depletion, pollution generation and population growth. What these models are missing is a specification of socially desirable policy targets for these variables.

Presumably, prescriptive global models would have a bigger impact on actual policy making than they now enjoy if they would offer concrete descriptions of the policy targets underlying their dynamic paths and if they would investigate the feasibility and social optimality of these policy targets. Only once a given set of policy targets is shown to be achievable and socially preferable to the other sets of achievable policy targets, has a strong argument been made. The sweeping reforms propounded by many global modelers are unlikely to gain practical acceptance in the absence of such an argument.

This paper is concerned with the portrayal of policy targets which set a global model on a socially optimal transition path to a socially optimal steady state. The methodology of finding these targets can be described succinctly with reference to a very simple global model. Of the many ingredients to the satisfaction of those human needs commonly treated by global models, our model will be concerned with only two: food production and pollution. A framework for the empirical study of these two ingredients and their interdependence has been provided by Cumberland (1966), Daly (1968), Leontief (1970), and others. Our model is constructed at a much higher level of aggregation than these and has a somewhat more general theoretical structure (e.g. it is not based on fixed-coefficient production functions). Although it would not be difficult to include ingredients other than food production and pollution in our analysis, the main principles underlying the derivation of the optimal policy targets can be uncovered quite simply with reference to these two.

In our model, the criteria for the choice of an optimal global steady state and the choice of an optimal transition path to this steady state emerge as a strainghtforward application of optimal control theory (much in the spirit of D'Arge and Kogiku (1973), Forster (1973), Keller, Spence, and Zeckhauser (1972), Mäler (1974), Plourde (1972), and Smith (1972)). It will be shown how the optimal global steady state depends on technological relations and social preferences. We will describe the policy targets which lead to this steady state along an optimal transition path from a conjectural current state. Our analysis suggests that the derivation of these targets calls for more than casual attention, for their dynamic properties may seem paradoxical at first sight.

In particular, the optimal target paths for our model are not monotonic through time. Assuming that the current state of the world system is characterized by a pollutant stock which is rising and greater than the optimal steady state stock, we find that the optimal food production target and the optimal anthropogenic pollution treatment target both reverse their direction of movement through time. By contrast, the global models in vogue today do not recommend such intertemporal reversals. Under the assumption above, these models would characteristically prescribe monotonic target movements through time (e.g. an asymptotically vanishing rise in anthropogenic pollution treatment).

Our conclusion regarding the intertemporal reversals of the food production target and the anthropogenic treatment target should not suggest that this "behavior mode" (to use the terminology of Meadows et al. (1972)) must invariably be observed in real-world policy making. A broadening of the scope of our analysis to include capital accumulation, resource depletion, and population dynamics may imply the social optimality of a different behavior mode. Our conclusion simply suggests that the optimality of monotonic target movements cannot be taken for granted. Current global models have perhaps treated policy target dynamics in too cavalier a fashion.

A possible objection to the control-theoretic treatment of global models may be the computational difficulty of such an undertaking. Several global models contain a large number of variables and equations and for these the computation of optimal state and control trajectories may be an unmanageable task. Yet this circumstance does not necessarily imply that these models escape the need to justify their prescriptions in terms of competing alternatives. In many cases it may be possible to simplify and aggregate the relations of a global model -- i.e. to build "a model of a model", much as Nordhaus (1973) did with respect to Forrester's model (1971) -- and the small-scale version may then be subjected to optimal control analysis. Surely such an indirect defense of global policy prescriptions is better than no defense at all.

In the next section, a simple descriptive global model of food production and pollution is constructed. Then the final section deals with the prescriptive counterpart of this model and investigates the social optimality of the associated policy pargets.

3. A Simple Descriptive Model

As noted above, our model restricts itself to the interrelated problems of food production and pollution. The many other sources of human material well-being which are commonly examined by global models -- capital accumulation, resource depletion, population growth, and so on -- are not considered here. Accordingly, only three outputs are generated by our world economy: good, pollutants, and pollution treatment services. The world population and labor force are assumed to be constant; all other factors of production (natural resources, capital equipment, land, etc.) are held constant as well.

Both food and the pollution treatment service are assumed to be nondurable. The flow of food, F, satisfies a consumption demand. The flow of treatment services, T, reduces the stock of pollutants. The available factors of production are used to produce these two outputs. The technological relation between these outputs may be described by a production possibility frontier:

$$(1) \quad T = T(F), \qquad \text{where } T' < 0,\ T'' < 0.$$

The production and consumption of F as well as the procution of T generate a flow of pollutant emissions:

$$(2) \quad \dot{P}_E = g(F,T), \qquad \text{where } g_F,\ g_T > 0;\quad g_{FF},\ g_{TT} > 0;\quad g_{FT} = 0.$$

The pollutant may be cleansed (viz, transformed into harmless substances) by the anthropogenic treatment service (T) and by natural treatment processes (T_N), such as biodecomposition. The magnitude of the latter treatment service is assumed to depend on the existing pollutant stock:

$$(3) \quad T_N = h(P), \qquad \text{where } h' > 0,\ h'' < 0,$$

and P is the pollutant stock. Both treatment services are calibrated in such a way that one unit of treatment service corresponds to one unit of pollutant flow cleansed. The net pollutant flow generated by the economy is

$$(4) \quad \dot{P} = \dot{P}_E - T - T_N.$$

Substituting equations (1), (2), and (3) into equation (4), we obtain

$$(5) \quad \dot{P} = k(F,P), \qquad \text{where } k_F > 0,\ k_P < 0;\ k_{FF} > 0,\ k_{PP} > 0;\ k_{FP} = 0.$$

We call this technological relation the "production-pollution transformation function".

The descriptive model may be completed by including a forecast of food production under current economic policies (e.g. current agricultural subsidies). For simplicity, let the predicted food flow be constant through time:

$$(6) \quad F = \overline{F}.$$

Then the predicted pollutant flow may be described by the phase diagram of Figure 1. Point A is the global stationary state which the model predicts will be approached under current policies. This stationary state may be socially un-

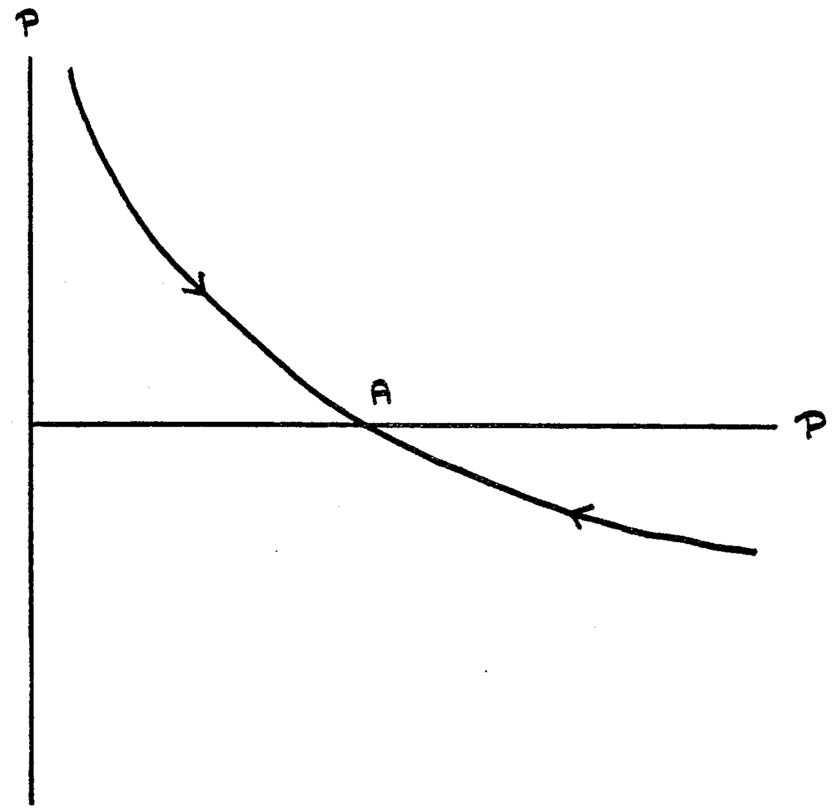

FIGURE 1

desirable; for example, it may be characterized by a level of pollution which is incompatible with human life.

A different dynamic path for food production would imply a different dynamic path for the pollutant flow. Global modeling efforts commonly center around the task of finding dynamic paths for F and $\dot{P}$ which are preferable to the paths generated by current policies. By contrast, we now inquire how the socially optimal paths for F and $\dot{P}$ may be identified.

4. Optimal Policy Target Dynamics

As a first step toward finding the optimal time paths of food production and the pollutant flow, we describe a conjectural state of the world system (in terms of F, $\dot{P}$, and P). Our description is based on two hypotheses:
(i) Given the current levels of anthropogenic and natural treatment services and given the current levels of food production and consumption, the pollutant stock is rising through time.
(ii) The current stock of pollutants is greater than its long-run, socially optimal, stationary state value.
Presumably, most environmental economists would concur with these hypotheses (although the realism of the first is impossible to establish at our level of aggregation and the second is a matter of value judgement).

Figure 2 depicts the production-pollution transformation function in terms of the food flow and the pollutant stock. The $\dot{P}=0$ function is upward-sloping, since $-(k_P/k_F)$ is positive. To the left of the $\dot{P}=0$ function, the production of food is sufficiently high and the anthropogenic and natural treatment services are sufficiently low for the polluant stock to rise. To the right of the $\dot{P}=0$ function, the pollutant stock falls. The long-run, socially optimal pollutant stock (which we have yet to derive analytically) is denoted by P^*.

Our first hypothesis implies that the conjectural current

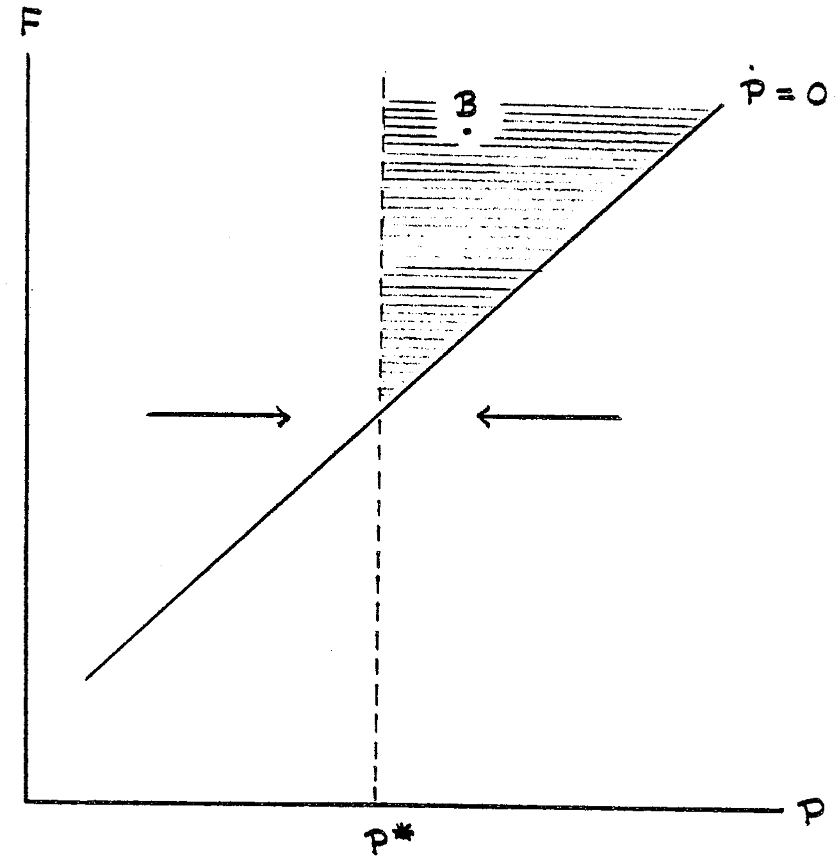

FIGURE 2

state of the world system lies to the left of the $\dot{P}=0$ function. Our second hypothesis implies that this state lies to the right of the P^* line. Hence, the conjectural current state is to be found somewhere within the shaded area of Figure 2; say, at point B.

In order to evaluate the social desirability of food flows and pollutant flows, it is convenient to postulate a social welfare function. Social welfare at any instant of time is taken to depend positively on the flow of food and inversely on the stock of pollutants:

$$(7) \quad U = U(F,P), \qquad \text{where } U_F > 0,\ U_P < 0;\ U_{FF} < 0,\ U_{PP} < 0;\ U_{FP} = 0.$$

The welfare effects of pollution are long lived. The present production and consumption of food generate pollutants which adversely affect welfare in the future. Thus, the problem of finding the socially optimal policy targets for food flows and anthropogenic treatment services is an intertemporal one. Let the welfare functional for the evaluation of the target paths be

$$(8) \quad W = \int_0^\infty e^{-rt} \cdot U(F,P)\, dt,$$

where r is the social rate of time preference.

The optimal target paths may be identified by maximizing this function subject to the production-pollution transformation function:

$$(9) \quad \text{Maximize} \quad W = \int_0^\infty e^{-rt} \cdot U(F,P)\, dt$$

$$\text{subject to } \dot{P} = k(F,P),$$

where F is the control variable and P is the state variable.

The first-order conditions for social optimality imply the following differential equations for food production and the pollution flow, respectively:

$$(10)\quad \dot{F} = \left(\frac{F}{\sigma^{U}_{FF} - \sigma^{k}_{FF}}\right) . \left[\left(\frac{U_P}{U_F}\right) . k_F + (r - k_P)\right]$$

$$(5)\quad \dot{P} = k(F,P),$$

where $\sigma^{U}_{FF} = (U_{FF}/U_F) . F < 0$

(the elasticity of marginal utility from food consumption with respect to food consumption) and

$$\sigma^{k}_{FF} = (k_{FF}/k_F) . F > 0$$

(the elasticity of marginal net pollutant flow from F with respect to F) are both assumed to be constants.

Figure 3 illustrates the trajectories satisfying the first-order conditions. Of all these trajectories, the only ones which also satisfy the sufficient conditions for social optimality lie on the two branches of the saddle-point path, denoted by the dashed line SPP in Figure 3. It can be shown that the saddle-point path must be downward-sloping. The socially optimal stationary state is described by point (P^*, F^*), which lies at the intersection of the $\dot{F}=0$ and $\dot{P}=0$ functions.

The optimal transitional trajectory leading from the conjectural current state to the optimal stationary state is pictured in Figure 4. This trajectory may be characterized in terms of its underlying food production target and anthropogenic treatment target. The movements of the two targets may be divided into short-run, medium-run, and long-run components. The short run is sufficiently short for the pollutant stock to remain at its historically given, initial value. The medium run is sufficiently long to permit changes

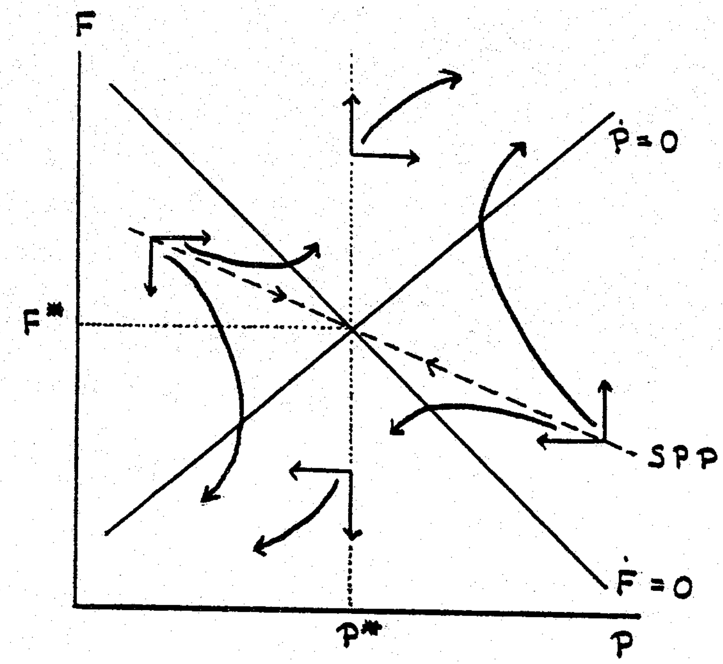

FIGURE 3

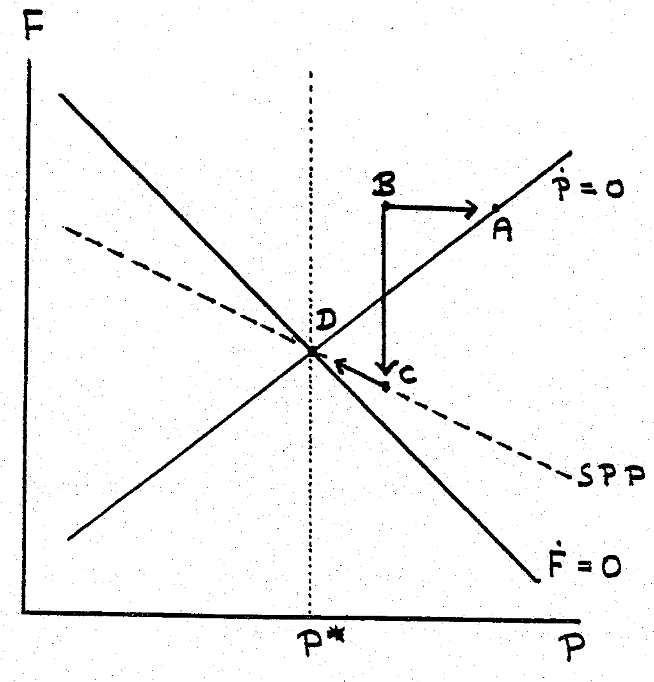

FIGURE 4

in the level of the pollutant stock, but not long enough for the optimal stationary state to be reached. In the long run the complete adjustment from the conjectural current state to the optimal stationary state takes place.

With regard to this temporal classification scheme, it is evident that the world system must move from point B to point C in the short run. Thus there must be a short-run fall in the food production target and a short-run rise in the anthropogenic treatment target. (A fall in the latter target is required, because (a) the pollutant stock and, with it, the natural treatment service remain unchanged in the short run and (b) the pollutant stock is increasing at point B and decreasing at point C.) In the medium run, a movement from point C to point D must be induced. Consequently, the food production target must rise while the anthropogenic treatment target must fall. (The rise in the food production target necessitates a transfer of factors into food production from pollution treatment.) In the long run, the entire transition from point B to point D is completed; the latter point is characterized by a lower food flow and a lower pollutant stock than the former.

In sum, the socially optimal dynamic paths of the food production target and the anthropogenic treatment target are implicit in the trajectory BCD in Figure 4. This trajectory differs from the forecast trajectory of the descriptive global model: BA in Figure 4 (where point A in Figure 4 corresponds to point A in Figure 1). It is noteworthy that both targets reverse their direction of movement along their optimal paths: the food production target falls in the short run and rises in the medium run, while the anthropogenic treatment target rises in the short run and falls in the medium run.

The desirability of such intertemporal reversals has not been investigated by global models thus far. Naturally, the fact that these reversals are optimal in our simple model does not mean that they must also be optimal in a more complex analytical setting. But certainly this matter deserves some serious attention. It cannot be taken for granted that the monotonic target paths, which are so common in prescriptive global models, are necessarily the best paths to be followed.

The second hypothesis underlying our description of the conjectural current state implies that the stock of pollutants should be reduced in the long run. It is possible to achieve this reduction through monotonic changes of the targets. Figure 5 illustrates the trajectory that would be induced by such a policy. Throughout the trajectory there is a steady fall of the food production target and a steady rise of the anthropogenic treatment target. In the initial phase of this trajectory, the production of food is sufficiently high and the treatment of pollution is sufficiently low that the pollutant stock rises. Yet as resources are transferred out of food production and into anthropogenic pollution treatment, the pollutant stock rises at a slower and slower rate and eventually falls toward P^*.

This trajectory may be socially more desirable than the forecast trajectory BA, but it is not optimal. The argument that trajectory BD is preferable to trajectory BA is not a foolproof defence of the policies underlying BD. For our model it has been shown that the optimal trajectory implies intertemporal reversals of both targets and trajectory BD does not meet this prerequisite.

This does not mean that a global modeler who advocates the policies underlying trajectory BCD (of Figure 4) necessarily has a compelling case. His policy recommendations depend, in part, on his choice of social welfare functional and in this area there is room for disagreement among equally informed and far-sighted people. For example, another global modeler may be more "pollution conscious" or less "consumption conscious"; in particular, this second modeler may favor a social welfare fucntional with a higher marginal utility of food (U_F) or a lower marginal disutility of pollution ($-U_P$). In Figure 6, the optimal trajectories associated with the two differing social preferences are compared. The $\dot{F}=0$ function

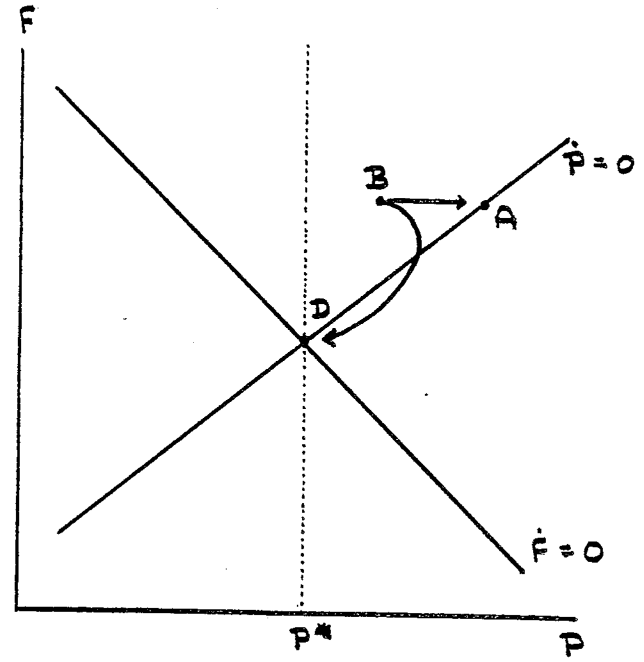

FIGURE 5

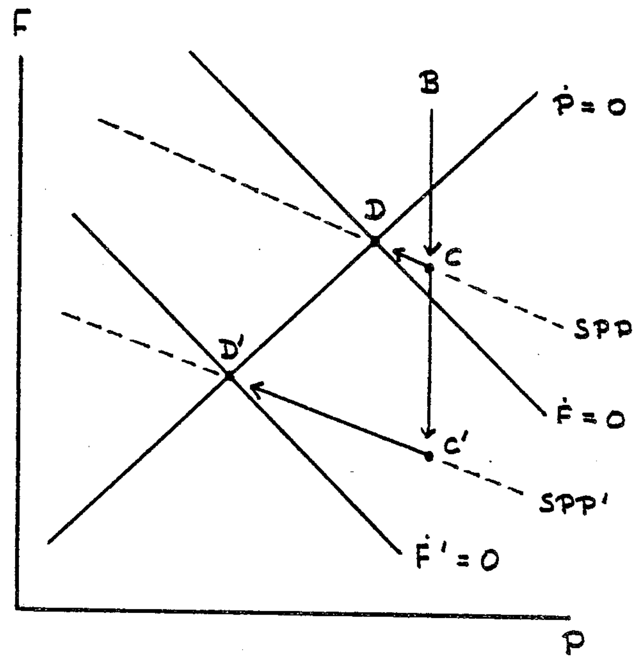

FIGURE 6

of the second modeler lies beneath that of the first modeler. (The reason is that, with reference to equation (10), $(\partial\dot{F}/\partial U_F)$ and $(\partial\dot{F}/\partial U_P)$ are both negative, while $(\partial\dot{F}/\partial F)$ is positive.) Consequently, the second modeler's saddle-point path lies beneath that of the first modeler. Thus, the second modeler recommends a larger short-run fall of the food production target, a larger short-run rise of the anthropogenic treatment target, and a larger long-run fall of the pollutant stock.

This type of disagreement over policy formulation is certainly conceivable. In a similar vein, global modelers may have different conceptions of technological relations in the future and these differences also lead to divergent policy recommendations. Such policy disagreements may be difficult to resolve, but it is certainly useful to trace them back to differences in social preferences and in technological assumptions. This identification of fundamental reasons for policy disagreement is not possible under present global modeling practice, whereby policy recommendations are defended by merely showing that they are preferable to current (or predicted) policies. Surely, many mutually exclusive sets of policies may be improvements over the current ones, but demonstrations to that effect do not indicate which of these set of policies should be implemented. Only once such demonstrations are abandonned in favor of investigations into the social optimality of recommended policies, is there hope of deciphering the basic reasons for policy disagreements.

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