Global Economic Model for New International Order*

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I. Movement Toward a New International Economic Order

Recently, in the field of economic sciences, as in other fields, the waves of change-the-times are surging forward, signifying that the frameworks for the economic sciences which held in the past are losing their efficacy and becoming unable to respond to many of the changes inherent in the new conditions that typify the world scene.

This is in part because the angles of vision utilized by economists in the past have been too narrow. For example, to look at the economies of the major advanced industrial countries of Japan, America, and Europe, these economies have multitudinous links of an international character, and if there should be changes in the state of the economies in these major countries, these changes very soon make themselves felt through the entire world, or, as may be seen in the case of the "oil shock," the "oil strategy" of the OPEC countries has not only produced a large impact on the economies of the industrially advanced countries, but has at the same time given rise to even more serious respercussions on the economies of many of the developing countries—once again indicating the existence of a "systems structure" of mutual interdependence in the global economy.

Efforts to look squarely at the realities of this interdependence among countries and to systematize them within a framework of economic theory have up to now remained, by and large, outside the purview of economists. In short, economists in the past have focussed their attention not so much on the economic relations among countries as on the economies of single countries, confining their discussions largely to such questions as the type of price mechanisms by which domestic economies move, the resultant allocation of resources under such-and-such a price mechanism, or the sorts of repercussions and effects on a country's economic tenor which might be induced by government expenditures.

Recently, in quite a different dimension from the above-mentioned problems, we are obliged to consider simultaneously a number of matters, any one of which has international extensions—whether it be the much discussed theme of economic growth; whether it be problems of resources and energy; whether it be problems of food, population, inflation, or the natural environment; or whether it be inquiries into human values or the uses of information. The trans-national character of these questions radically shakes the very foundations of any system which pretends to be based on a single country, and furthermore calls into question the meaning of "economic security."

Of course, it is possible that there may ae cases in which one can solve problems at the level of a single country or region, but there are also times when an economic policy of a given country causes a very large negative effect on the economic security of other countries. We are now indeed at an hiscorical stage characterized by a new and global economic order of interdependence. It is indeed this very fact that raised the curtain on the "Global Age" which is now directly before us.

In brief, we are at this very moment facing an experience never known before. For example, in regard to problems of natural resources

and, in particular, of petroleum (which is the natural resource receiving the greatest attention on the international scene), the possibility that petroleum might in the future become exhausted was a problem which remained outside the framework of the science of economics as it existed heretofore. Of course there were no economists who carried on research or made predictions regarding, for example, what sorts of strategies the Arab oil producing nations might adopt in the event of a drying-up of oil resources, or what sorts of impact a situation of global oil depletion would have on the world economy.

Owing to such conditions of inexperience, it is necessary that we search for indications of how the world economy is likely to change in the future and for the course that the coming international economic order ought to take.

As is generally known, it was the report of the Club of Rome entitled "The Limits to Growth" which, treating such questions as environment, resources, food and population as a single world system, first predicted that the world economy, under the constraints imposed by resources, could not continue to exhibit the same patterns of economic growth that had prevailed in the past. This report, the result of studies by the group around prof. Meadows, and based on the world model developed by prof. Forrester of M. I. T., attracted worldwide comment and interest.

A characteristic feature of the above model is that it takes the world as a single unit, dealing with such major variables as population, production, food, resources, pollution, etc., as totals for the entire planet. For this reason, the model was powerless when it came to analysis of so-called "North-South" relationships—i.e., the economic relations between the developing and the industrially advanced countries—which determine the framework for the global economic order. The "policy conclusions" from this world model are that in order to maintain a future balance

among global population, resources and environment, it will be necessary for industrially advanced countries to achieve a zero growth in production, and for developing countries to attain a zero population growth. However, this model does not make clear the sorts of effects on the developing countries' economies that would result from a zero growth in the important economies of the industriallyadvanced countries.

Moreover, criticism of the phrase "limits to growth" has arisen especially from among the developing countries. This is because the developing countries, in order to free themselves from economic poverty, have to increase production. Because increasing production is connected with growth, the idea of a "zero growth pattern" is difficult to accept. In the case of the industrially-advanced countries, because they already have high standards of living, they can at least maintain present standards of living even if the rates of economic growth were to slow down somewhat.

Thus, if economic growth were to be accepted at the present point, even though such a situation might be accepted by the industrially advanced countries which are already ahead in resource consumption, such a proposition has given rise among the developing countries, to arguments that it would be greatly to their disadvantage.

A subsequent task, then came to be that of constructing a world model which, dividing the world into several regions, would allow for relationships of interdependence among them. The report entitled "Mankind at the Turning Point," presented by Professors Mesarovic and Pestel at the West Berlin meeting of the Club of Rome in October, 1974, was an attempt to respond to the above problem.

They criticized the method of treating the world as a single unit as had been done in the "Limits to Growth" model, and instead divided the world into 10 regions as follows: 1) North America, 2) Western Europe,

3) Japan, 4) Australia and other advanced market economy regions ; developing market economy regions in the four areas of 5) Asia, 6) Middle East and North Africa, 7) Rest of Africa, 8) Middle and South America; centrally-planned economy regions subdivided into 9) Soviet Union and Europe, and 10) China and other Asian socialist countries.

The Mesarovic and Pestel world model was constructed using the techniques of general systems theory, which are somewhat different from the "system dynamics" techniques used by Prof. Forrester. In so far as it is not limited just to an "economic sector" but accommodates sub-sectors dealing with such things as population, food, energy, etc., it is similar to the model produced by the above-mentioned Meadows group, but is characterized by the especially large amount of attention paid to relationships among the factors of economic growth, population, food, and energy, particularly, oil.

Mesarovic and Pestel, using the above model, deduce a number of forecasts corresponding to various scenarios.

For example, if the OPEC countries should adopt policies of raising the price of oil as a matter of strategy, this, of course, could, in certain cases, give rise to countermeasures on the part of industrially-advanced countries, while opposition and contradictions would be expected to occur, and worldwide economic security might be lost, with all countries running into extraordinary crises.

This sort of strategy can be seen in due course to rebound negatively against the OPEC countries themselves and so it is seen that such action could by no means constitute a well-advised policy.

It may be concluded that there is a need for every country to put more effort into reasonable reforms, with international co-operation as a goal to be striven for. What constitutes the greatest brake on these needed reforms and international co-ordination is the perception of op-

posing interests among nations, arising from current conceptions of national sovereignty.

This situation is the greatest factor which necessitates change—and immediate change — in value outlooks. The tradition of each country acting in accordance with its own national ego is the basic evil which is causing a loss of control in coping with new problems at the global level. Comparing this sort of situation to the human body, if cancer cells should be allowed to grow and expand according to their own convenience, the body will be exposed to mortal danger. In the same way, if each country should behave in such a way as to pursue economic growth and "security" only in accordance with its own "natioanl interests" or "national advantage," it is possible that such behavior could invite serious crises for the whole of humanity. Mesarovic and Pestel thus conclude that a new international economic order must be sought from the perspective of the whole of the human race.

The Tinbergen report entitled "Reshaping the International Order," presented at the Algiers meeting of the Club of Rome in October, 1976, is an attempt to respond to questions such as those suggested above. This report takes the freshapproach of seeking a couse for the new international order within the framework of "humanistic socialism." In other words, he stresses the point that in order to realize a truly egalitarian society which guarantees human dignity and fundamental rights, it will be necessary to alter the present framework of international order and to build up a society of "humanistic socialism" through dialogue and solidarity between the industrially advanced countries and the developing countries.

As is well known, in the "Declaration and Program of Action for the Establishment of a New International Economic Order" adopted by the 6th Special Session of the United Nations General Assembly in April,

1974, also in the "Charter of Economic Rights and Obligations Among Nations" of December of that year, and again in the adoption of the Lima Charter of UNIDO in March 1975; the demands of the developing countries have been focused on what is known as a "new international economic order." At the same time, on the basis of the deepening relations of interdependence between the industrially advanced and the developing countries, a mood of dialogue and co-operation has gradually arisen to eclipse the more extreme aspects of North-South confrontation. The tuning points in this trend may be said to be the Conference on Development and International Economic Cooperation held as a part of the 7th Special of the United Nations General Assembly in September, 1976, together with the Conference on International Economic Cooperation held in Paris in December of 1975. The same spirit was inherited by the 4th General Meeting of UNCTAD held in Nairobi in May, 1976.

The above-mentioned Tinbergen report, which, through a re-examination of the present international economic order, attempts to suggest directives for a new international economic order, has a rather different character from the research done using the world models of the Meadows group or of Mesarovic and Pestel. In short, the Tinbergen report places its main emphasis on research of a qualitative rather than a quantitative nature, and is characterized by its attempt to set up an analytic system linked with the specific ingredients of the international economic order for purposes of establishing mutual relationships among such things as economic development, price stabilization for primary commodities, multinational corporations, technology transfers, resources, environment, welfare problems, etc.

As we can see from the above, we have now arrived at an age in which it is not a matter of "putting old wine into new skins", but rather of putting into new skins things of a dimension—namely, the new ways

of thinking and, indeed, the new civilization which are the requisites for opening new dimensions in world history. We will no doubt have to refine and purify the accomplishments of those who have gone before us and search for creative directions in which to apply some of these accomplishments to good purpose in the new age.

We are being pressed by the need for new philosophical concepts and for new methods of scholarship which will, for example, in the field of "economic sciences", approach problems not just from the traditionally narrow scope of "economic", but in terms of comprehensive systems which can accomuodate a great many fields of study such as environment, resources, population, food, education, welfare, and human values, all in terms of a world system of interdependence among nations.

Tinbergen's model may be said to represent one new course of analysis in terms of a world system, but we have still only begun to stand at the door of analysis using "world models", and one might say that in this field of study there are almost limitless possibilities wating to be uncovered in the future.

On the basis, then, of the above outline of the types of problems to which we are directing our attention, let us today proceed to study what kinds of long-range impacts on the world economy and on the international economic order are caused by the limitation of petroleum and other primary products, and to search for desirable directions for the long-range development of our global society.

II. Considerations Derived From Macro-Models of the World Economy

1) Research aims and background

When we nowadays speak of "resource limitations", we must remember that, in a certain sense, the possibility is already before us that

cases may arise in which limitations of certain resources will affect the entire planet in important ways.

For example, the possibility is now in sight that limited resources of petroleum may become depleted in the not-so-distant future. It is petroleum that is now the most immediate question before us, but one cannot, of course, say the possibilities are nonexistent that at some later time in the more distant future various other natural resources, such as copper or tungsten, will become exhausted. However, at the same time, humankind, faced with dwindling resources, will probably discover new possibilities for substitutes. In other words, as dwindling resources inevitably acquire a higher "scarcity value", humankind will probably be able to find a way out of this predicament by developing other substitute resources, by recycling, etc.

However, at the present moment immediately facing us, long before we run up against the above kind of physical restrictions on resources, matters such as the relationships between the developing and the industrially advanced countries (including difficult North-South problems) or conflicts and contradictions between resource-possessing countries (which are not necessarily from among the ranks of the developing countries) and non-resource-possessing countries are everyday realities which constitute great political and economic issues.

The developing countries, looking with displeasure on the present world economic order, whose managment (including the management of resource development) has up to now been centered very predominantly in the industrially advanced countries of the so-called "North", are demanding the right to justice and equality in international society and are strengthening their consciousness with regard to participation in the formation of a new world economic order.

After the Second World War, one of the very foremost aims of the

developing countries, having achieved liberation from colonial status, was in finding ways to attain economic self-standing as a follow-up to political independence. This meant getting rid of formerly existing colonial-type economic structures and aiming at conversion to economic characteristics and industrial and trade structures similar to those possessed by industrially advanced countries at the present time. Expressed in another way, a large portion of the developing countries nurtured the intention of escaping from a pattern of international division of labor by which it was almost entirely the industrially ladvanced countries which manufactured industrial goods, while the developing countries supplied primary products such as industrial raw materials and foodstuffs. This was, then, in a certain sense, a strategy for a shift to an industrialized society, albeit in most cases a strategy for industrialization on a solid agricultural base.

As for the stated goal of building self-reliance on the basis of domestic economies, favorable conditions for bringing such a goal to fruition were, for a large and resource-endowed country like China, present. However, the majority of the developing countries are small nations and, as before, escape from economic reliance on other countries proved quite impossible. Moreover, to change radically the structure of exports proved to be a difficult and long-range task. Thus, most of the developing countries were made to shoulder the dilemma of having to proceed with development within an economic system whose trade structure remained, as before, similar to that of colonial times, relying to an overly large extent on the export of primary commodities.

One must recognize the fact that the industrially-advanced countries continue, as before, to occupy an important and, in a sense, central position in the present international economic order and that the growth patterns of developing countries are greatly affected by the sorts of

growth patterns in industrially advanced countries. If, for example, within the industrially advanced countries there should be substantial development of products which substitute for certain natural raw materials, trade in those raw materials is likely to show a relative slackening off, and in such cases there has heretofore operated a mechanism whereby the economic growth of the developing countries which rely on exports of those materials will be suppressed.

When industrially advanced countries enter an economic slump, prices of a whole array of primary commodities tend to fall precipitously. It is at times when economic conditions in industrially advanced countries are restored and these countries again begin to make larger purchases that the prices of primary commodities tend to rise. Thus, economies which rely to too great an extent on the export of primary commodities are very sharply affected by changes in worldwide economic climate.

Therefore, the developing countries must think about how, in the process of aiming at a stabilization in the prices of primary commodities, they can break free from the above type of "economic growth" and attain greater economic security. At the same time, beginning the First General Meeting of UNCTAD in 1964, the developing countries, with a view to expanding their exports of manufactured and semi-manufactured goods, have presented the industrially advanced countries with strong demands for freer markets and for adjustments in the industrial ·structures of the latter. At the Fourth General Meeting of UNCTAD in May, 1976, focal points of the discussions, aimed at price stabilization of primary products, included the possible creation of internationally controlled buffer stocks of primary commodities and a system of price "indexation" with respect to export prices of manufactured good from the industrially advanced countries.

However, in the event of such an "indexation" of primary commodity

prices, it is still not very clear what sorts of influences on the world economy would be brought about, or whether or not this would be the first step toward the solution of the "North-South problem." The reason for this statement is that nothing of this nature can be known with any degree of assurance without first transforming into a model the dynamic "systems structure" of the world economy, characrerized by interdependence among the developing and the industrially advanced countries, and then, with the use of computers, proceeding with the attempt to obtain credible forecasts.

In this connection, we may say that the aim of developing our Global Economic Model (GEM) is to make clearer the systems structure of "North-South" economic relations throughout the world, to forecast long-range trends in the economic development of global society as we go forward toward the 21st century, and to provide guidelines for making correctives in the course to be followed toward a desirable world economic order.

2) Basic structure of the Global Economic Model

As we can see from above, all world economic models take the whole of global society as their objects of study, but one might classify these models, according to the approach they adopt, as follows: 1) those which are "unitary" in the sense that they treat aggregate figures for the whole world; 2) those which divide the world into several regions linking up sub-models for each region; and 3) those which divide the world into economic units corresponding to each individual nation, attempting to clarify the systems of economic interdependence among them.

A representative example of the first approach is the Forrester world model; a representative example of the second approach is the model developed by Mesarovic and Pestel, while Klein's "Link Project" and our own Multi-national Economic Model are examples of the third appr-

oach. The Global Economic Model (GEM) that we now have available for use was developed on the basis of the Multi-national Economic Model, about which a report was given at the General Meeting of the Club of Rome in October, 1974.

With this "macro-type" Global Economic Model as a core, we have been engaged in constructing a more truly comprehensive world model which will link up such various sub-systems as education, scientific research and development, welfare, food, resources, energy, pollution, environment, "degree of sensitivity" to mutual interdependence among countries, and indexes of a given society's degree of industrialization and degree of movement toward a "post-industrial" stage.

The Global Economic Model (GEM), links 15 areas of the world, subdivided as follows:

I. (Advanced market economies)

1) Japan, 2) United States, 3) Canada, 4) Extended European Community, 5) Australia and New Zealand, 6) Other areas with advanced market economies

II. (Developing market economies)

7) East Asia, 8) Southeast Asia, 9) South Asia, 10) Other parts of Asia, 11) Near and Middle East, 12) Africa, 13) Caribbean and Latin America

III. (Centrally-planned economies)

14) Soviet Union and Eastern Europe, 15) China and other centrally planned economies in Asia

While the GEM represents a system linking together "sub-models" which reflect the special characteristics of these 15 regions, each sub-model, in turn, is composed of "sub-sectors" as follows: i) Production; ii) Expenditures on gross regional product at constant market prices; iii) Profits and wages; iv) Prices; v) Expenditure on gross regional product

at current market prices; vi) Official development assistance and private overseas investment.

These sub-sectors are in organic international with each other, and the regional sub-models are mutually linked through the flows of trade, official development assistance and private overseas investment.

The most important distinguishing feature of this Global Economic Model is the systems structure it utilizes for determining inter-regional trade. The system at work is one whereby economic growth in each region does not take place completely on a basis of self-reliance, but rather with a framwork of interdependent relationships characterized by trade and financial flows.

This model treats official development assistance (ODA) from industrially advanced regions to developing regions as a generally-agreed policy aim of governments and inter-governmental bodies. Official development assistance from the industrially advanced countries is, of course, distributed among several different developing regions, and this distribution ratio may be conceived as a "policy parameter".

The GEM recognized that the present situation is one whereby increases in official development assistance and in private overseas investment depend very largely on income levels in the industrially-advanced regions, and whereby, on the part of the developing regions, such aid is seen as offering considerable promise as a supplementary factor for production, helping, in turn, to increase incoms in those regions. Thus, official development aid, together with trade, creates an important link in the interdependent relationships among the developing and the industrially advanced regions.

In designing the model, particular attention was given to the various UNCTAD discussions and propositions on stabilizing prices for the major primary commodities exported from the developing countries, in an

attempt to make the model as receptive as possible for considering such questions.

3) A look at some of the model-derived forecasts

The structure of the "macro" GEM having been discussed above, let us proceed with an account of how, using the model, we attempted to derive outlooks for North-South economic relations (based on the interdependent relations among the 15 world regions) up to the year 2000.

In order to obtain a forecast from the GEM, a prerequisite condition is that one consider a given "scenario". A so-called "scenario" can be drawn in various ways depending on posited changes in structural parameters, in policy variables or in exogenous variables.

The scenario in which we are first of all interested is the question of what, up to the year 2000, will be the patterns of population and economic growth in the various parts of the world, and just what will become of the economic gap between North and South. The resultant forecast envisages a tendency for the tempo of economic growth in the industrially advanced regions (including Japan) to fall somewhat and for the tempo of economic growth in the developing regions to rise somewhat, but still, the gap in per capita incomes will probably continue to widen. It is likely that income inequalities in our global society will increase and that there will in the future be a tendency toward even sharper opposition between North and South.

Secondly, we ask whether, under supposition of a further widening in the income and technology gap between Northern and Southern economies, there can be policies designed to diminish this gap. In this connection, if the industrially advanced regions slow down their rates of growth, what sorts of impacts will this have on economic development in the developing regions? Our forecast is that so long as there is no change in the structure of the present world economic system centered

about the industrially advanced countries, a lowering of the tempo of economic growth in the industrially advanced regions is likely to cause a lowering of the tempo of economic development in the developing regions, which have strong links to the former, especially through trade and official development assistance. Thus, so long as the present mechanisms of world industry and trade move according to patterns seen heretofore, it may be understood that zero growth in the industrially advanced regions would not contribute to diminishing the North-South gap but would only have the effect of tending to freeze and perpetuate the present state of inequality.

Thirdly, in relation to the building of a new international economic order for the 21st century, and with the supposition of a more equitable distribution of natural resources to the various regions of global society, we ask whether, if it were possible, in conjunction with a slowdown in the tempo of economic growth in the industrially advanced countries, to increase greatly the flow of funds (official development assistance, private foreign investment, etc.) to the developing regions, such a process could contribute to diminishing the North-South gap. Of course, unless the additional flow of funds from the industrially advanced to the developing regions were greater than the export reductions in the developing regions would likely accompany a falling back in the tempo of economic growth in the industrially advanced countries, the tempo of economic development in the developing regions would not be expected to rise. According to the forecasts derived from the Global Economic Model, if the rates of economic growth in the industrially advanced regions' were cut by 10%, it would be necessary to elevate these regions' official development assistance considerably above present levels in order to avoid a lowering of growth rates in the developing regions. In such a case, the balance of trade of the industrially advanced regions with respect to the

developing regions would tend to take a favorable turn, and so such an increase in the flow of funds would be rational policy.

Fourthly, in the process of restructuring North-South economic relations within a new international economic order, it is necessary that the transition of the developing regions to industrialized societies be encouraged, but at the same we must ask what the various impacts of this industrialization will be, and what will be the response of the industrially advanced regions. The transition of developing countries to industrialized societies does not necessarily mean following in the footsteps of today's major industrially advanced countries, along a path of industrialization characterized by an "over-consumption" of energy and resources. As for policy response by the industrially advanced regions, it is obviously necessary that, from a viewpoint favoring more equitable use of the earth's resources, there must be a change from patterns of overconsumption to an economic system characterized by resource conservation. One may even say that it is desirable, for purposes of encouraging recycling and controls on resource overconsumption, that prices of such primary resources as industrial raw materials be maintained somewhat on the high side. On the other hand, however, there are, of course, apprehensions lest increases in resource prices accelerate world inflation. We have attempted to analyze this problem using the Global Economic Model.

Looking at the results calculated from the model, as long as resource prices do not go beyond certain limits of expansion which allow for effective policy response, they do not appear likely to become an important factor which would accelerate world inflation. While rises in resource prices may or may not, then, be a major problem, one can definitely say that inflation is very largely the result of such factors in market economies as wage costs, pressures from demand, and flaws in the balance

between currency and incomes. From the GEM computations, it it is seen that if we can succeed in controlling these factors in a planned and systematic way, it is not impossible that moderate rises in resource prices could be absorbed within plans for overall stabilization in commodity prices.

Fifthly, in regard to the stabilization of primary commodity prices, the GEM may be used to study scientifically such questions as buffer stocks and indexation with respect to prices of manufactured goods, as discussed at the Fourth General Meeting of UNCTAD.

In addition to the 10 items given primary attention by UNCTAD (namely, tea, coffee, cocoa, sugar, copra, cotton, jute, sisal, tin, and copper), we included in our study two others (rice and wheat) and found that movements in the prices of these primary commodities are linked most especially to increases or decreases in stocks and to movements in wholesale prices in the industrially advanced countries, which are greatly influenced by American prices as a standard. One can say, then, that primary commodity prices are, under the present international economic order, already, in effect linked with wholesale prices in the United States. , This means that so long as U. S. wholesale prices remain unstable, it will be difficult to stabilize primary commodity prices by means of buffer stocks. It is also seen in the forecasts given by the GEM that if wholesale prices in the major industrially advanced market economies (and especially in the U.S.) can be stabilized, primary commodity prices through buffer stocks may be possible.

This means that in order to effect the stabilization of primary commodity prices—one of the most important problems for a new international economic order—a precondition is that countries with advanced market economies must, through a strengthening of the elements of planning in their economies, attempt with more success to stabilize who-

lesale prices and fluctuations in business climate.

Through studies of such questions as the above, the following conclusions may be drawn from the GEM on the basis of its forecasts of future trends in the development of our global society.

Continuing into the 21st century, the greatest task which global society faces is that of how to build a new international economic order. The aims of such a new order may be said to be a more equitable utilization of global resources and greater equality on the plane of human and social welfare. To make this new order a reality, it will be necessarily of short and intermediate duration.

Essential in the short and intermediate range is that the developing countries should have greater purchasing power to aid establishartat of themselves more squarely on a developmental course. Keynes once argued in favor of a policy of creating more effective demand on a single-country level as a measure for dealing with economic slump in the industrially advanced countries. In today's global society, however, measures for dealing with economic slumps in the industrially advanced countries cannot be discussed without attention being given to the interdependent relations with the developing countries. Also, looking at this problem from a global point of view, the mutual adjustment of economic policies and maintenance of a moderate economic growth on the part of the industrially advanced countries is a precondition for imparting greater purchasing power to the developing countries. Going beyond this, dynamic international arrangements must be established whereby the developing countries production and levels of purchasing power can be raised through such means as technology transfers, rules and regulations on the conduct of multi-national corporations to help insure that their operations will be of positive value, increases in development aid, and stabilization of primary commodity prices.

Also, we must search for a more rational international division of labor among the industrially advanced and the developing countries. At present, the industrially advanced countries have a comparative advantage in the export of goods and services that are relatively "knowledge-intensive" while the developing countries tend to have a comparative advantage only in the export of "labor-intensive" goods and services. We may say that changes in the present North-South industrial and trade structures should follow this kind of pattern, although doubts arise to the effect that this may not be possible to realize without changes in present-day human values and in economic and social systems. These questions are, then, related to the long-range course of development for global society.

4) Long-range course of development for global society

The principle that has up to now been dominant in the world economy has basically been, one might say, the principle of "survival of the fittest." In the coming age of deepening global constraints, one must ask if human society can survive at all with a continuation of such behavior.

In the absence of a change from the traditional principle of "survival of the fittest" to the principles of international co-operation and human solidarity, or likewise in the absence of changes from systems of wholly unrestrained free competition to systems incorporating a greater element of planning and co-ordination, it will probably be most difficult to overcome the various conflicts which we face in the world economy, to guarantee each country's economic security, and to plan for a higher degree of social welfare.

With respect to guaranteeing each country's economic security, there arise important questions of "strategy." One course would be to move in the direction of self-reliance, while another course is that of mutual interdependence. So long as relations of mutual trust are maint-

ained among nations, a collective security system of mutual interdependence is fully possible. Howevre, in periods of distrust between nations, attempts to gain economic security though self-reliance almost invariably come to the fore. Choices between complete self-reliance and interdependence may reflect, in certain cases, choices between war and peace. In situations in which war is deemed likely or under wartime conditions, systems of interdependence cease to function and coutries feel obliged to aim toward courses of self-reliance.

Thus, however great the sacrifices made for the sake of self-reliance, if there is a lack of trust among nations of, in certain cases, the danger of international tensions that should possibly lead to war, countries may find themselves resorting to courses of self-reliance.

On the other hand, in a peaceful world without such apprehensions, the possibility emerges for coutries economic security be realized within a system of interdependence.

The question of whether the 21st century will be "open"or "closed" will no doubt be related to whether, in regard to dwindling resources, human society chooses to attempt to solve conflicts of interest by means of military force, whether human wisdom can gain the upper hand during a dangerous era and build a new international economic order which would be a system of world economic security based on peaceful interdependence without resort to war.

Let us now consider how such a system of economic security for our global society might best be established.

With regard to the problem of resources, it is evident that if development patterns such as have prevailed heretofore in the industrially ladvanced countries are to be continued, sharp periodic fluctuations in resource prices are likely to occur, as well as various detrimental effects on the natural environment. Consequently, we should abandon the

age in which each country has pursued its economic growth in its own arbitrary and self-seeking way, and should be ready to meet the new age characterized by the need for international cooperation from a global viewpoint, planned coordination based on a keener feeling of human solidarity, and systems for an international control over resources. If this is not successfully done, human society will inevitably run into a great crisis.

In order to collectively pursue economic security in a world of interdependent relationships, it should be self-evident that we need not only to build a better system of worldwide development information to provide data on economic growth planning related to population, food, resources, energy, environment, trade and the like, but also to construct practical action plans on a global scale.

Since it appears likely that mankind, by using up resources according to patterns of development hitherto characcreristic of the industrially advanved countries, threatens to give rise to intolerable pollution and a depletion of the earth's resources, we shall be obliged, even if it takes a great many years, to design radical new recycling systems for resource retrieval and re-utilization.

For the time being, there is the need to control human desires, and especially to create patterns of resource, energy and food conservation thereby, insofar as possible, the industrially advanced countries refrain from "over-consumption," although this alone will not solve our problems. In any case, however, human desires are under constraint to be in harmony with nature, and this fact leads us to grope for directions toward systems of harmonious adjustment between nature and human society. Someday these efforts will probably lead to the formation of so-called "closed systems" of resource recycling. We see the perfection of such systems as likely to become an important basic principle of the

global society of the 21st century.

In relation to this problem, it will be necessary to build regulatory and adjustment mechanisms to insure that science and technology will be utilized for the whole of humanity. In order to deal effectively with such matters as "the internationalization of environmental pollution" or the "North-South problems" which we presently face in our human society, there is a need to strengthen science-related co-ordinating bodies and functions in which all humankind has an interest.

As industrially advanced societies in the future move toward "post-industrial" stages, an especially-high value is placed on the fruits of science and technology. However, if such fruits of scientific development should be retained in a more or less monopolistic way only by certain multinational corporations or only by certain industrially advanced countries, without being transferred and assimilated in the developing countries, there will arise extremely great problems of "technology gap." The crises we presently face are very serious, and can probably not be overcome unless the fruits of science and technology are utilized by all of humankind.

Consequently, the question of whether such a system, its field of vision emcompassing all of the human race, can or cannot be realized, is, then, a great challenge for the system of human society in which we presently live.

In this regard, a thoroughgoing strengthening of international bodies will be essential to attain global harmony in economic policies. With the present global system, each country's relations of mutual interdependence are in fact becoming greater. In such an international environment, unless the economic policies of each individual country (which take into consideration each country's "national interest") are adjusted from the world as a whole, it will probably be impossible for us to solve the prob-

lems of economic security on the global level. We are directly facing, at this moment, a period that demands planning at the global level. However, little progress will be made without a change in methods and without a reform in human value judgments.

Type I

Global Economic Model

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I. Production

1. $$\left(\frac{x^{**}}{l}\right) = z_a\left\{\alpha + \beta\left(\frac{\overset{t-4}{\underset{t}{\sum}}\Delta s^*_p}{l}\right) + \gamma\left(\frac{\overset{t-4}{\underset{t}{\sum}}r^*_d}{l}\right)\right\} + z_b\left\{\alpha + \beta\left(\frac{\overset{t-4}{\underset{t}{\sum}}\Delta s^*_p}{l}\right)\right.$$
$$\left. + \gamma\left(\frac{\overset{t-4}{\underset{t}{\sum}}r^*_{ed}}{l}\right)\right\} + z_c\left\{\alpha + \beta\left(\frac{\overset{t-4}{\underset{t}{\sum}}\Delta s^*_p}{l}\right) + \gamma\left(\frac{\overset{t-4}{\underset{t}{\sum}}r^*_d}{l}\right)\right\}$$

2. $r^*_d = \alpha + \beta x^*_{-1}$

3. $d^* = \alpha + \beta s^*_{p-1}$

4. $r^*_{ed} = \alpha + \beta r^*$

5. $x^* = \phi\left(\frac{x^{**}}{l}\right) \cdot l$

6. $s^*_p = s^*_{p-1} + \Delta s^*_p - d^*$

7. $l = (1 - \bar{u}) l_{cs}$

   $z_a = 1, \ z_b = 0, \ z_c = 0$ (for AME) AME : Advanced Market
   Economies

   $z_a = 0, \ z_b = 1, \ z_c = 0$ (for DME) DME : Developing Market
   Economies

   $z_a = 0, \ z_b = 0, \ z_c = 1$ (for CPE) CPE : Centrally- Planned Economies

II. Expenditure on GRP (at constant prices)

1.
$$e^*_{(i,j)} = \check{z}_a \{A + Bx^*_{(j)-1}\} + \check{z}_b \{A + B[e^*_{(j)-1} + (\sum o_{da(i,j)} + \sum \Delta s_{op(i,j)}$$
$$+ \bar{a}_m + \bar{a}_{c-1})] \cdot \left[\frac{p_{e(j)}}{p_{m(j)-1}} + \Gamma x^*_{(j)-1}\right] + \check{z}_c A + B \left[e^*_{(j)-1} \cdot \right.$$
$$\left. \left(\frac{p_{e(j)}}{p_{m(j)-1}}\right)\right\}$$

($\check{z}$ relates to importing region (j).)

2. $c^* = \alpha + \beta x^* + \Gamma c^*_{-1}$

3. $g^* = \alpha + \beta r^*$

4. $r^* = \alpha + \beta x^*_{-1}$

5.
$$\Delta s^*_p = \check{z}_a \cdot \Lambda \{\alpha + \beta y^*_{c-1} + \Gamma e^*_{-1} + \delta i_{-1} + \varepsilon [o_{da} + \Delta s_{op}]_{-1}\}$$
$$+ \check{z}_b \cdot \Lambda \{\alpha + \beta x^*_{-1} + \Gamma [e^*_{-1} + (\sum_i o_{da(i,j)} + \sum_i \Delta s_{op(i,j)} + \bar{a}_m$$
$$+ \bar{a}_c)_{-1}] \cdot \left[\frac{p_{e(j)}}{p_{m(j)-1}}\right]\} + \check{z}_c \{\alpha + \beta x^*_{-1} + \Gamma \bar{a}_c\}$$

6. $\Delta s^*_h = \alpha + \beta x^* + \Gamma p_{h-1} + \delta i_{-1}$

7. $\Delta s^*_i = x^* - e^* + m^* - g^* - \Delta s^*_p - \Delta s^*_h - \Delta s^*_i$

8. $e^* = \beta \sum_j e^*_{(i,j)}$

9. $m^* = \beta \sum_i e^*_{(i,j)}$

III. Profit-Wage

1. $y^*_c = \alpha + \beta x^*$

2. $\omega = \alpha + \beta p_{c-1} + \Gamma p_y + \delta \bar{u}_{-1}$

3. $p_y = \left(\frac{x^*}{l}\right) / \left(\frac{x^*_0}{l_0}\right)$

IV. Prices

1. $p_w = \alpha + \beta p_{m-1} + \Gamma \left[\frac{\omega}{p_y}\right] + \delta \left(\frac{x}{x^*}\right)_{-1} + \varepsilon i_{v-1}$

2. $p_c = \alpha + \beta p_{w-1} + \Gamma \omega + \delta p_{m-1} + \varepsilon i_{v-1}$

3. $p_{cg} = \alpha + \beta p_{w-1} + \Gamma \omega + \delta i_{v-1}$

4. $p_i = \alpha + \beta p_w + \gamma \left(\dfrac{\Delta s^*_p}{x^*} \right)$

5. $p_h = \alpha + \beta p_i + \gamma \omega$

6. $p_e = \bar{z}_a \{ \alpha + \beta p_w + \gamma l_{qw-1} + \delta p_{m-1} + \varepsilon \left(\dfrac{x}{x^*} \right)_{-1} \}$

$\quad\quad + \bar{z}_e \{ \alpha + \beta p_w + \gamma l_{qw-1} + \delta p_{m-1} + \varepsilon p_{ec} \} + \bar{z}_o \{ p_{eE} \}$

$\quad\quad\quad\quad\quad\quad\quad\quad\quad$ ($\bar{z}$ relates to exporting country (i).)

7. $p_m = \{ \sum_i [p_{e(i)} \cdot e^*_{(i,j)}] \} / [\sum_i e^*_{(i,j)}]$

8. $p = \dfrac{x}{x^*}$ $\quad\quad\quad$ 9. $i_v = \left(\dfrac{m_s}{m_{so}} \right) / \left(\dfrac{x^*}{x^*_o} \right)$

$\quad \bar{z}_a = 1, \;\; \bar{z}_b = 0, \;\; \bar{z}_c = 0, \;\; \bar{z}_o = 0 \,$(for AME)

$\quad \bar{z}_a = 0, \;\; \bar{z}_b = 1, \;\; \bar{z}_c = 0, \;\; \bar{z}_o = 0 \,$(for DME excluding OPEC)

$\quad \bar{z}_a = 0, \;\; \bar{z}_b = 0, \;\; \bar{z}_c = 1, \;\; \bar{z}_o = 0 \,$(for CPE)

$\quad \bar{z}_a = 0, \;\; \bar{z}_b = 0, \;\; \bar{z}_c = 0, \;\; \bar{z}_o = 1 \,$(for OPEC)

V. Expenditure on GRP (at current prices)

1. $e = p_e \cdot e^*$ $\quad\quad$ 2. $p_m \cdot m^*$ $\quad\quad\quad$ 3. $e = p_c \cdot c^*$ $\quad\quad$ 4. $g = p_{cg} \cdot g$

5. $\Delta s_p = p_i \cdot \Delta s^*_p$ $\quad$ 6. $\Delta s_h = p_h \cdot \Delta s^*_h$ $\quad$ 7. $\Delta s_i = p_w \cdot \Delta s^*_i$

8. $x = e - m + c + g + \Delta s_p + \Delta s_h + \Delta s_i$

9. $b = \bar{z}_a [e - m + j - \Delta s_{op} - o_{da}] + \bar{z}_b [e - m + j + \sum_i \Delta s_{op} + \sum_i o_{da} + \bar{a}_m + \bar{a}_c]$

$\quad\quad + \bar{z}_a [e - m + j - \bar{a}_o]$

VI. Official Development Assistance and Private Overseas Investment

1. $o_{da} = \Pi \cdot x$

2. $\Delta s_{op} = \theta \cdot x$

3. $\sum_i o_{da(i,j)} = \Omega \cdot o_{da}$

4. $\sum_i \Delta s_{op(i,j)} = K \cdot \Delta s_{op}$

5. $s_{op} = s_{op-1} + \Delta s_{op} - f_d$

Where

x A column vector of n element which denotes gross regional product (at current market prices) of n regions in the world.

$x*$ //   gross regional product at constant prices.

$x**$ //   potential gross regional product at constant prices.

$e*_{(i,j)}$ An element of $e*_{(i,j)}$ matrix which denotes exports from region i to region j (at constant prices).

e A column vector of n element which denotes exports of goods and services at current prices.

$e*$ //   exports of goods and services (at constant prices).

m //   imports of goods and services (at current prices).

$m*$ //   imports of goods and services (at constant prices).

c //   private final consumption expenditure (at current prices).

$c*$ //   //   (at constant pricess).

g //   government final consumption expenditure (at current prices).

$g*$ //   //   (at constant prices).

$r*$ //   government current revenue (at constant prices).

Δs_h //   housing investment (at current prices).

$\Delta s*_h$ //   //   (at constant prices).

Δs_p //   non-housing investment (at current prices).

$\Delta s*_p$ //   //   (at constant prices).

Δs_i //   increase in stockes (at current prices).

$\Delta s*_i$ //   //   (at constant prices).

$s*_p$ //   fixed capital stocks (at constant prices).

$d*_p$ //   depreciation of fixed capital (at constant prices).

$r*_d$ //   research and development expenses (at constant prices).

y_c //   corporate profit (at current prices).

$y*_c$ //   corporate profit (at constant prices).

l A column vector of n element which denotes employment (in terms of man-hour).

$\bar{l}_{cs}$ //   civilian labour force (in tems of man-hour).

$\bar{u}$ //   unemployment ratio.

ω //   average wage and salary per employee (at current prices) index.

$\bar{i}$ //   average interest rate on loan.

ρ //   foreign exchange rate (in terms of dollar).

b //   basic balance of payment.

$\bar{j}$ //   balance of the capital accounts.

p_y //   labor productivity index.

i_v //   money supply-real income index.

p //   implicit deflater of GRP.

p_c //   implicit deflater of private consumption expenditure (consumers prices index).

p_{cg} //   implicit deflater of government consumption.

p_i //   implicit deflater of fixed equipment investment.

p_h //   implicit deflater of housing investment.

p_w //   implicit deflater of increase in stocks (wholesale price index).

p_e //   export price index.

p_m //   import price index.

o_{da} //   each AME region's total official development assistance (net).

$o_{da(i,j)}$ An element of $o_{da(i,j)}$ matrix which denotes official development assistance from AME region i to DME region j.

Δs_{op} A column vector of n element which denotes each AME region's overseas private investment (net) to DME regions.

$\Delta s_{op(i,j)}$ An element of $\Delta s_{op(i,j)}$ matrix which denotes overseas private investment from AME region i to DME region j.

$\bar{a}_m$ A column vector of n element which denotes each DME's official development assistance (net) received from multilateral agencies.

$\bar{a}_c$ //   each DME's official development assistance (net) receivved from centrally planned economy zone.

$\bar{m}_s$ //   money supply.

r^*_{ed} //   government education expenditure

$\hat{p}_{eE}$ //   oil export unit price index.

$\hat{l}_{qw}$ //   world liquidity-trade index.

$\hat{p}_{ec}$ //   export price index of primary commodities.

t Denotes time.

$-$ Denotes the exogenous variables of the model.

$\tilde{z}$ Denotes dummy variables.

A A n x n matrix which denotes the constants of export functions from region i to region j within the world.

B, Γ, Ξ A n x n matrix which denotes the coefficients of export functions from region i to region j in the world.

α A column vector of n element which denotes the constants of a group of structural equations.

β, γ, δ A diagonal matrix of a n x n order which denotes coefficients of θ, λ, π $\varepsilon, \phi, \mu, \psi$ a group of structural equations.

$\bar{\Pi}, \bar{\Theta}, \bar{\Omega}$ Development assistance policy parameters.
$\bar{K}$