

THE FUTURE OF THE WORLD ECONOMY

**A United Nations Study
by Wassily Leontief *et al.***

NEW YORK
OXFORD UNIVERSITY PRESS
1977

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Library of Congress Catalogue Card Number: 77-72024

Printed in the United States of America

Preface

This report is intended to present the preliminary results of a study, made under the auspices of the United Nations, on the impact of prospective economic issues and policies on the International Development Strategy for the Second United Nations Development Decade. The detailed model of the world economy described in this report is far from a finished piece of work. Additional time and resources are urgently needed to verify and correct the initial estimates of its parameters and to refine its structure. Some of the conclusions presented in the report are drawn from numerical solutions of the model. These conclusions may have to be revised as corrections and improvements are introduced. Elaborations and extensions were recommended by the *ad hoc* Expert Group that reviewed the system. These should broaden the scope and value of its applications.

In the computations for the central scenarios, regional growth rates of Gross Domestic Product were fixed by assumption. These growth rates were chosen for exploratory purposes. They do not represent official United Nations goals and should certainly not be interpreted as predictions of future trends.

Primary financial support for the study was provided by the Government of the Netherlands through a grant to the United Nations in 1973, following discussions with the then Under-Secretary-General for Economic and Social Affairs, Mr. Philippe de Seynes. Additional financial support, which permitted a number of consultants to prepare special analyses, was provided by the United Nations and the Ford Foundation. Fundamental research on input-output analysis was sponsored by a grant from the United States National Science Foundation to Brandeis and Harvard Universities. These grants afforded partial support for work on the world model.

The team of principal investigators responsible for building the world input-output model and for the computation of the projections included in this report was under the direction of Wassily Leontief and included Anne P. Carter and Peter Petri (of Brandeis University), with Joseph J. Stern (of Harvard University) serving as a co-ordinator for the project. Richard Drost (of Brandeis University) wrote the programmes with which the various computations were performed. All of the computations were performed at Brandeis University on the PDP-10 at the Feldberg Computer Center. Ira Sohn (of New York University) assisted Professor Leontief in the final stages of preparation of the report.

Many offices and organizations of the United Nations family generously provided statistical information and relevant reports. The authors are especially grateful to the Economic Commission for Europe of the United Nations, which prepared a special study of interindustry relations in Europe; the Food and Agriculture Organization of the United Nations, for generously making available a large amount of data on the agricultural sector in various regions of the world; the International Labour Office and the Population Division of the United Nations Secretariat for providing demographic data. In addition, the World Bank gave us access to its vast amount of data pertaining to the developing economies.

In the original conception of the study, it was hoped that research organizations in various countries, especially the developing countries, would be asked to undertake specific studies and data collections. Actually, this proved to be difficult, partly because the time available to complete the study was too short to permit effective liaison to be established between the research staff at Brandeis and Harvard Universities and overseas research institutes. Nevertheless, the assistance of the Development Centre of the Organisation for Economic Co-operation and Development (OECD) which distributed the project outline and interim reports to the members of its world-wide network of research institutions is gratefully acknowledged. As is suggested in the report, further analysis of the environmental problems can and indeed must call upon the statistical and analytical talents of research institutions throughout the world.

The authors are pleased to note that the General Assembly in two important resolutions, 3345 (XXIX) on research on the interrelationships between population, resources, environment and development, and 3508 (XXX) on long-term economic trends and projections, has already called for United Nations work in this area. In this context the Department of Economic and Social Affairs of the United Nations Secretariat is initiating a major activity, under the title "Project 2000", which is designed, in collaboration with the regional commissions and other organizations of the United Nations system, to examine alternative patterns of development through the remainder of the twentieth century and their policy implications.

During the course of the nearly three years of work, numerous administrative and substantive matters arose requiring guidance and interpretation. At United Nations Headquarters, Jacob L. Mosak, Director of the Centre for Development Planning, Projections and Policies and Deputy to the Under-Secretary-General for Economic and Social Affairs, helped guide the project; Dallas H. Steinhorsen, Principal Officer, and subsequently Stanislav M. Menshikov, Assistant Director of the Centre, helped to maintain liaison with the United Nations. Mr. Menshikov and Munidasa Kodikara, Senior Officer of the Centre, assisted on a number of substantive matters and parts of the report. Mr. Hiroshi Niida, Senior Officer, also assisted in the initial stage of the project. Their help is gratefully acknowledged. United Nations experts commented on the work in progress and shared their views and knowledge during a number of meetings.

Without the support, knowledge and assistance of the many persons who contributed directly and indirectly to the research effort, the work would have been more difficult and the result less satisfying. None is, of course, responsible for any shortcomings of the study or for any interpretations of the statistical resources which they so generously supplied. Responsibility for the factual analysis rests solely with the authors. The report is put forward in the hope that it will stimulate further thought and work on the quantitative analyses of long-term global development policy.

Explanatory notes

The following symbols have been used in the tables throughout the report:

Three dots (...) indicate that data are not available or are not separately reported

A dash (—) indicates that the amount is nil or negligible

A blank in a table indicates that the item is not applicable

A minus sign (–) indicates a deficit or decrease, except as indicated

A full stop (.) is used to indicate decimals

A slash (/) indicates a crop year or financial year, e.g., 1970/71

Use of a hyphen (-) between dates representing years, e.g., 1971-1973, signifies the full period involved, including the beginning and end years.

Reference to "tons" indicates metric tons, and to "dollars" (\$) United States dollars, unless otherwise stated.

Annual rates of growth or change, unless otherwise stated, refer to annual compound rates.

Details and percentages in tables do not necessarily add to totals, because of rounding.

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The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

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INTRODUCTION AND SUMMARY

The basis for the present report is a study on the environmental aspects of the future world economy. This study includes—as a principal feature—a set of alternative projections of the demographic, economic and environmental states of the world in bench-mark years 1980, 1990 and 2000.

The detailed methodology and substantive findings of the study are released in parts one and two of the present report. This introduction is meant to give a short history of the project and to summarize the findings and conclusions of the study having the most immediate interest for the current deliberations on the future of the International Development Strategy and ways of implementing the new international economic order.

The setting of the project

The International Development Strategy adopted in 1970 expressed concern with the environment and stated that national and international efforts should be intensified “to arrest the deterioration of the human environment and to take measures towards its improvement, and to promote activities that will help maintain the ecological balance on which human survival depends”.¹

Since 1970, environmental concerns have received increasing attention. At the international level, these have been most notably manifest in the 1972 United Nations Conference on the Human Environment,² in the founding, in the same year, of the United Nations Environment Programme (UNEP) and in its subsequent activities, in an intensification of environmental programmes of United Nations organizations, in the establishment in 1974 of the International Habitat and Human Settlements Foundation (General Assembly resolution 3327 (XXIX)), and in the decision to hold a United Nations conference on human settlements in 1976 (General Assembly resolutions 3001 (XXVII) and 3128 (XXVIII)). At the national level, many Governments have adopted more numerous and more effective environmental policies. The interest of people and Governments has intensified rapidly and in many directions.

Within the United Nations governing bodies, member States have decided that environmental policies should imply for the International Development Strategy no weakening of the thrust to make the world, in its economic and social aspects, a more just and rational home for mankind. On the contrary, a number of resolutions of the General Assembly and the Economic and Social Council, especially Assembly resolution 3002 (XXVII) of 15 December 1972, emphasized that environmental

policies should enhance the attainment of the goals and objectives of the Strategy and should ensure that the development priorities of the developing countries set out in the Strategy were in no way adversely affected or distorted.

At present, the whole question of the environment and the Strategy clearly falls within the broad range of considerations which led to the Declaration on the Establishment of a New International Economic Order and the corresponding Programme of Action and to General Assembly resolution 3362 (S-VII) on development and international economic co-operation. In particular, the General Assembly decided that modifications to the Strategy must take account of that Declaration and Programme of Action.

In accordance with these principles, the United Nations initiated in 1973 a study on the impact of prospective economic issues and policies on the International Development Strategy, on which the present report is based. The objective of the study was to investigate the interrelationships between future economic growth and prospective economic issues, including questions on the availability of natural resources, the degree of pollution associated with the production of goods and services, and the economic impact of abatement policies. One question specifically asked by the study was whether the existing and other development targets were consistent with the availability and geographic distribution of resources. To the extent that some resources are limited should the desired growth be modified? Does increasing concern with pollution and protection of the environment as a whole seriously affect economic development and call for a re-examination of various national and international development targets? These and other questions were to be investigated within the framework of this study.

Although the 1970s have been designated as the Second United Nations Development Decade, certain policies, especially those relating to environmental factors, are more realistically viewed from a longer-term perspective. While the potential impact of environmental constraints may not impinge to any substantial extent on development over the medium-term, the cost of postponing actions that take account of such potential factors may be great.

The impact exerted by environmental conditions and policies on the growth and structure of the world economy generally becomes apparent only gradually and in the long run. Environmental conditions and policies, however, are highly pertinent to the International Development Strategy for the Second United Nations Development Decade, despite the Strategy's single-decade format. This is because, despite this format, the Strategy is coming to be viewed more and more as a contribution to a cumulative, long-run process, as evidenced, for example, by its recent linking in General Assembly decisions with the concept of a new international economic order.

This approach is significantly new, because despite the

¹ *International Development Strategy: Action Programme of the General Assembly for the Second United Nations Development Decade* (United Nations publication, Sales No. E.71.II.A.2), para. 72.

² *Report of the United Nations Conference on the Human Environment* (United Nations publication, Sales No. E.73.II.A.14).

other ways in which it was a historic step forward, the present Strategy was originally concerned with the perspective of a single decade without explicitly taking into account longer-range problems such as those that have recently come to the fore in the context of the conferences on environment, on population and on food, and most importantly, in the context of the decisions on a new international economic order. In this respect, the climate of opinion prevailing today differs significantly from that of 1970, and may, therefore, call for a re-assessment of the underlying thrust of the Strategy. Accordingly, while the goals and objectives of the International Development Strategy have been reaffirmed and have been complemented by related decisions, there has arisen at the same time a feeling that the long-term implications of present international policies deserve closer scrutiny. Such scrutiny could throw useful light on some future consequences of present policies, and conversely, could help disclose some needs for action in the 1970s imposed by mankind's future requirements.

The global model

To provide a quantitative basis for the study, a global economic model of the world economy has been constructed. The purpose of the model is to display various possible interrelationships, as the world economy evolves over future decades, between environmental and other economic policies. With respect to time horizons, the world economy of 1970 is depicted and compared with hypothetical pictures of the world economy in 1980, 1990 and 2000.

Despite its global scope, the model displays an unusual degree of detail. The world economy is divided into 15 regions—namely, four developed market regions (North America, Western Europe (high-income), Japan and Oceania); two developed centrally planned regions (the Union of Soviet Socialist Republics and Eastern Europe); six developing market regions (Latin America (medium-income), Latin America (low-income), the Middle East and African oil countries, Asia (low-income), Africa (arid) and Africa (tropical)); one region including the countries of Asia with centrally planned economies; and two medium-income regions (Western Europe (medium-income) and Southern Africa).

Each region is described in terms of 45 sectors of economic activity. In agriculture, four specific subsectors are analysed—namely, livestock products, grains, high-protein crops and roots. With respect to mineral resources, special accent is placed on copper, bauxite, nickel, zinc, lead, iron ore, petroleum, natural gas and coal. Manufacturing activities are divided into 22 sectors, such as food processing, primary metals, textiles, fertilizer, various types of machinery and equipment. There is separate treatment of utilities and construction, trade and services, transportation and communication. The model describes emissions of eight types of major pollutants and five types of pollution-abatement activities.

Though each of the 15 regions is treated separately, the model also brings them together through a complex linkage mechanism, including exports and imports of some 40 classes of goods and services, capital flows, aid transfers, and foreign interest payments. The model also permits a detailed analysis of prospective changes in technology, cost of production and relative prices.

The model was constructed in the first instance for the study of development in relation to environmental questions. The principal environmental policies considered are those concerning pollution, constraints on the extraction of mineral resources and the production of food. However, as can be clearly seen from the above description, the model is basically a general-purpose economic model and is thus applicable to the analysis of the evolution of the world economy from other points of view.

Because of these features of the global model, the scope of the study was broadened to include, in addition to environmental aspects, some other problems of economic development. Based on results of model computations, the study investigates in a very broad framework such problems as food and agriculture, mineral resources, pollution and pollution abatement, structural changes in the economies, balance of payments and changes in international economic relations. It is hoped that the model will have a continuing life in which fresh data are used as they become available and in which the model is eventually applied to other development questions.

The degree of detail in the model is advantageous since it permits the use of data specific to individual industries in particular regions, and consequently results in conclusions of relatively specific policy significance. This will provide a basis for continuing contributions to the quantitative analysis of the evolving world economy, such as that requested in General Assembly resolution 3345 (XXIX), entitled "Research on the interrelationships between population, resources, environment and development", and especially in General Assembly resolution 3508 (XXX), which calls for long-range projections of economic development, first at the regional and then at the global level.

The International Development Strategy and alternative scenarios of development

As a bench-mark against which to measure the future impacts of environmental and other economic policies, hypothetical pictures (scenarios) of the world economy are needed. Most of the alternative scenarios analysed in this study embody various assumptions about rates of growth of population and of gross product *per capita*.

One possible scenario was to use growth targets set by the International Development Strategy for the Second United Nations Development Decade. These targets, for the developing regions as a whole, are set at 6 per cent per annum for gross product and 3.5 per cent for gross product *per capita*, assuming an average 2.5 per cent annual growth of population.³

The targets were reaffirmed in 1975 at the seventh special session of the General Assembly in the resolution adopted on development and international economic co-operation.⁴

The International Development Strategy does not set targets for growth in developed countries. However, if previous long-term trends in these countries were extrap-

³ *International Development Strategy: Action Programme of the General Assembly for the Second United Nations Development Decade* (United Nations publication, Sales No. E.71.II.A.2), paras. 13-15.

⁴ General Assembly resolution 3362 (S-VII) of 19 September 1975, preamble.

olated, they would mean an annual growth of about 4.5 per cent in gross product and 3.5 per cent in gross product *per capita*.

If the minimum targets of growth for the developing countries, as set by the International Development Strategy, were implemented continuously throughout the remaining decades of this century, and if the growth rates prevailing in the developed countries during the past two decades were to be retained in the future, then the gap in *per capita* gross product between these two groups of countries, which was 12 to 1 on the average in 1970, would not start diminishing even by the year 2000. It is true that gross product in the developing countries would continue to expand somewhat faster than in the developed countries, and thus the share of the developing countries in total world product would increase. However, because of the much higher growth rates of population, the expansion of gross product *per capita* would be no faster in the developing countries than in the world as a whole.

This outcome is clearly contrary to the spirit of the International Development Strategy and the Declaration on the Establishment of a New International Economic Order, which call for the correction of inequalities and the redressment of existing injustice, making it possible to narrow the gap between the developed and developing countries and to ensure steadily accelerating economic and social development and justice for present and future generations.⁵ It is for this reason that the International Development Strategy laid stress on the necessity to accelerate growth starting with the second half of the current decade in order to make at least a modest beginning towards narrowing the income gap between developed and developing countries.

For these considerations the study turned to different scenarios, in which growth rates of gross product *per capita* were set in such a way as to reduce, roughly by half, the income gap between the developing and the developed countries by the year 2000, with a view towards closing the income gap completely by the middle of the next century. It was felt that these scenarios were more consistent with the spirit of the International Development Strategy and the aims of the Declaration on the Establishment of a New International Economic Order.

Table 1 summarizes the basic differences between the two approaches and can be used to illustrate some of the basic features of the more consistent approach, which leads to a reduction of the average income gap from 12 to 1 in 1970 to about 7 to 1 in the year 2000.

To reach this goal, a substantially higher rate of growth of *per capita* gross product would be necessary in the developing countries. The study assumed that these higher rates could not be achieved immediately but that the acceleration would have to be a gradual step-by-step increase, starting with the current actual rates of growth in most of the developing regions. An exception was made for the Middle East and African oil countries, where a gradual decline from the currently very high growth rates (13-14 per cent) was considered a more realistic assumption. Under scenario C, illustrated in table 1, growth rates of population were based on the United Nations "low" projections. However, other

TABLE 1. HYPOTHETICAL SCENARIOS OF WORLD ECONOMIC DEVELOPMENT

	Scenario	Developed countries	Developing countries
Growth rates (percentage):			
Gross product	I ^a	4.5	6.0
	C ^b	3.6	6.9
Population	I	1.0	2.5
	C	0.6	2.0
Gross product <i>per capita</i>	I	3.5	3.5
	C	3.0	4.9
Income gap in the year 2000 ^c	I	12 to 1	
	C	7 to 1	

^a I indicates scenario based on extrapolation to the year 2000 of International Development Strategy targets for gross product increase in developing countries and extrapolated long-term historical rates in developed countries.

^b C indicates scenario based on substantial reduction of gap in gross product *per capita* between developing and developed countries.

^c Average *per capita* gross domestic product of the developed regions, as related to the average *per capita* gross domestic product of the developing regions.

scenarios, using the "medium" United Nations projections, were also found to be consistent with the basic goal of reducing the income gap.

With respect to developed countries a different rule was followed for projecting the growth rate of gross product. It was assumed that, as individual developed regions achieve higher levels of gross product per head of population, their growth rate of product *per capita* would decline. Thus, the growth rate of 4 per cent *per capita* would apply to regions in the \$3-4,000 income *per capita* range (in 1970 constant prices), a 3 per cent growth rate in the \$4-5,000 range, 2.5 per cent in the \$5-6,000 range and so forth. This has the effect of bringing down the average growth rate of gross product in the developed countries to 3.6-4 per cent in the final three decades of this century from the long-term trend of 4.5 per cent. It was felt that an assumption of gradually declining growth rates in the developed countries would be more realistic than would a simple extrapolation of their past performance.

Under such conditions of accelerated growth in most developing regions, in 1970-2000 average *per capita* gross product would increase 4 times in the Middle East and African oil countries, 3.6 times in the developing market economies of Asia and about 2.5 times in the non-oil countries of Africa.

Even under these relatively optimistic assumptions, by the year 2000 average gross product *per capita* would only reach about \$400 (in 1970 prices) in non-oil Asia and Africa, while other developing regions would be able to enter the \$1-2,000 range. This is owing to the relatively low current levels of *per capita* income in non-oil Asia and Africa, and to the current divergence in growth rates of different developing regions. Only in the early part of the next century could one realistically envisage more equality in average *per capita* incomes among the various developing regions.

To achieve the relatively low income target of \$500 *per capita* by the year 2000, non-oil regions of Africa and Asia would have to increase their gross product annual growth rates to more than 6.5-7.5 per cent as compared to the 5.5-6.5 range assumed in the study. While such higher growth rates are not impossible, especially favourable conditions relating to trade and payments,

⁵ General Assembly resolution 3201 (S-VI) of 1 May 1974, preamble.

transfer of technology and technical assistance would have to be created for the development of these areas. Under all circumstances it is clear that the income situation in these areas will continue to be acute in this century, and that more attention and concerted international effort favouring development of these regions is necessary.

Conditions of growth (I): food and agriculture

The first question that the study addresses itself to is whether the hypothetical scenario of world development just described is feasible, given the well-known constraints on growth, such as the availability of mineral reserves, the potential for food production and the levels of industrial and consumer pollution of the natural environment.

It is important to stress that the study proceeds from assumptions of population growth, as projected by the United Nations. According to these projections, which are based on a detailed analysis of fertility, mortality, age structure, urbanization and other basic factors underlying and determining population dynamics, growth of population is not an exponential process, or an exponential explosion, in which a constant growth rate is maintained. Rather these projections show that population growth rates first tend to increase, then to decline, after certain levels of income and degrees of urbanization are reached.

It follows from these projections that population growth rates in the developed regions will be falling already in the remaining quarter of this century, and that a stable state of population will be reached after 2025. The coming quarter century will, however, evidence a continuation of the very high rate of population expansion experienced in the developing regions between 1950 and 1975. However, population growth rates will start decreasing here in the first quarter of the next century, and a stable state probably will be reached after 2075. This outcome would be achieved not through mass starvation, but through demographic change occurring at relatively high levels of economic development.⁶

Whatever changes in population growth rates might occur in the future, it remains certain that there will be an extremely steep increase in total world population in 1975-2000 (by about 60 per cent), and particularly in the developing regions (about twofold). Thus, the pressure of increasing population upon the food producing potential of the world will remain enormous.

As stated in the International Development Strategy for the Second United Nations Development Decade, a 4 per cent rate of annual growth of agricultural production is consistent with a gross product growth rate of 6 per cent.⁷ Assuming higher over-all growth rates of the economies of the developing regions (an average of 7 per cent), and with full provision for changes in the structure of personal consumption (including the reduction of the share of food in total consumption, accompanying the increase in income levels), the average annual increase of agricultural production in the coming decades would have to be about 5 per cent.

⁶ See *Concise Report on the World Population Situation in 1970-1975 and Its Long-Range Implications* (United Nations publication, Sales No. E.74.XIII.4), pp. 58 and 59.

⁷ Although this target date was not achieved during the first half of the Decade, the World Food Conference held in Rome in 1974 reaffirmed the target for the second half of the Decade.

This assumes that the current levels of dependence by developing regions on imports from developed regions would not increase. If this dependence were increased, the burden of higher food imports on the balance of payments of non-oil Africa and Asia would rise substantially. However, it should be borne in mind that the difference between a 4 and 5 per cent growth rate in agricultural output would be, by 2000, larger in absolute terms than the total agricultural output in 1970. This clearly shows the difficulty of using imports of food as a major source of any substantial and continuous increase. The major thrust of food supply in the developing regions will have to come from an increase in their own agricultural output.

A 5 per cent annual growth of agricultural output is equivalent to a 4.3-fold increase in 30 years. This is quite a formidable task. However, a 4 per cent annual growth would compound to a 3.2-fold increase in the same period, and even a mere 2.5 per cent increase, consistent with maintaining at least today's very low food consumption levels, would necessitate a 2.1-fold increase of output by the end of the century. In addition, agricultural production in the developed regions as a whole would have to increase by at least 60 per cent in 30 years to assure an average rise in their agricultural consumption *per capita* of only 1 per cent per annum.

Will this task of expanding agricultural output be feasible? As shown in the study, all the developing regions have fairly large reserves of arable land which can be brought into cultivation, given adequate investment and institutional arrangements. It is physically possible to increase the land area under cultivation in the developing market regions as a whole by some 229 million hectares by the year 2000, or by 30 per cent as compared to the actual arable land total of 1970. Presumably, many substantial measures of public policy in the areas of land reclamation and irrigation, public and private investment, credit facilities, supply of necessary machinery and equipment, resettlement of agricultural labour and others would have to be taken in order to turn this physical possibility into a reality.

Even after mobilizing available excess arable land resources, land productivity (including crop yields and cattle productivity) would have to be increased at least threefold in the developing regions if the more optimistic target of a 5 per cent annual growth in agricultural output is to be achieved. If the more modest target of 4 per cent is retained, land productivity would still have to increase about 2-2.5 times. With a marginal growth of 2.5 per cent, and assuming full utilization of additional land, the necessary increase in land productivity is estimated at 60 per cent.

It should be added that, according to the study, even in the developed regions, where possibilities of expanding arable land are sometimes very limited, land productivity would have to increase by 60 to 100 per cent to satisfy their growing demand for agricultural products. Thus, the task of a new "green revolution" is not one that exists exclusively in the developing areas. But it is there that it is most acute and least supported, as of now, by adequate policies and resources.

The major task of drastically increasing land productivity within a 30-year time horizon is not without precedent in the recent history of world agriculture. In the United States of America agricultural output per unit of total land area under cultivation has increased on the average by 80 per cent in 1971-1975, as compared to 1941-

1945. Crop yields of wheat have increased by 90 per cent, and of corn 2.8 times within the same time period. In the Soviet Union agricultural output per unit of cultivated land has increased on the average by 79 per cent in 1971-1974, as compared to 1946-1950. Crop yields of grains are on the average twice as high as in the earlier period, while yields of cotton have increased 2.6-2.8 times.

Starting from a relatively high level, Japan has been able to increase its average rice yield in the last 30 years by about 30 per cent. Possibilities of much faster growth due to intensive irrigation were demonstrated recently in some developing South-east Asian countries where absolute yield levels were quite low before these programmes were started. Thus, in both the Philippines and Thailand average rice crop yields were increased by about 50 per cent between 1960 and 1970, which is equivalent to increasing 3.4 times in a 30-year period. In most developing countries crop yields are still far below those of Japan, and in all of them they are even farther from the 8 tons per hectare potential that is considered possible given the present state of technology, an irrigation rate of close to 100 per cent and adequate organization.

According to some estimates, the total investment necessary to bring the average crop yield in Asia to half the maximum (4 tons per hectare) would be over \$60 billion, including investment into irrigation, fertilizer plants, farm machinery, transport equipment and the like.⁸ It may be useful to note that similar schemes implemented in the Soviet Union have brought about a 45 per cent increase in average rice yields in the past 10 years, and that those yields have increased 2.3 times as compared to the late 1950s.

In wheat the progress in the 1960s was spectacular, both in the developed and in some developing countries. In Mexico, where the "green revolution" was initiated, crop yields of wheat increased 2.2 times between 1960 and 1970. In the same period, on a much larger scale, but in the substantially more complicated environment of India and Pakistan, the average wheat yield was increased by 50 per cent, which is equivalent to a 3-fold increase over a span of 30 years. In the Syrian Arab Republic in only five years (from 1970 to 1975) total agricultural production increased by 50 per cent, and the amount of irrigated land doubled.

With all the possible caveats about the unpredictability of weather conditions and the problems involved in implementing technological revolutions in agriculture, it is clear from these examples that, at least with respect to the major food staples, the doubling and trebling of land productivity is a realistic technical and organizational possibility. It is well known that crop yields and cattle productivity are, as a rule, relatively low in the developing countries. Thus, an increase of land productivity in these regions to current levels reached in the developed and some of the developing countries would be a significant contribution to meeting the targets discussed earlier.

This task clearly involves substantial investment into land improvement, irrigation, fertilizer production and distribution, research and development—especially the development of those kinds of plants and animals which yield best results in the peculiar natural environment of the regions and countries in question—education for

farmers and the like. Given the large excess labour potential in these regions a lot can be achieved by intensifying labour inputs into soil improvement and plant cultivation. Adequate provision would need to be made for foreign aid in the promotion of higher agricultural production and for the international transfer of progressive technology where applicable.

The success of the new technological revolution in agriculture of the developing regions depends to a large extent on land reform and other social and institutional changes, which are necessary to overcome non-technological barriers to increased land use and productivity. It also depends on creating, by special measures of agricultural policy, a favourable economic environment for agricultural development, including incentives directed towards eliminating inefficiencies in the use of land, labour and technology. If these conditions are met, then the formidable task of feeding the rapidly increasing population of the planet and of improving diets in all regions of the world will be fulfilled.

Conditions of growth (II): adequacy of mineral resources

According to the study, there will be a tremendous growth in the world consumption of minerals between 1970 and 2000. The demand for copper is expected to increase 4.8 times, for bauxite and zinc 4.2 times, nickel 4.3 times, lead 5.3 times, iron ore 4.7 times, petroleum 5.2 times, natural gas 4.5 times and coal 5.0 times.

These estimates were adjusted, wherever possible, to take into account the influence of future technologies on resource development and consumption. Account was taken of potential savings of primary resources through increased recycling. The maximum potential for recycling of many materials under continuing growth, estimated to be about 55 per cent, was assumed to be achieved in all regions by the end of the century. In spite of the new, more rational and economic ways of using mineral resources, the world is expected to consume during the last 30 years of the twentieth century from 3 to 4 times the volume of minerals that has been consumed throughout the whole previous history of civilization. Are the finite reserves of minerals in the earth's crust adequate to sustain this demand?

The study points to the uncertainties of estimating both future stocks of mineral resources and future demands for minerals. Resources already known to exist will be supplemented to an unknown extent by new discoveries in the future, as they were in the past. The degree to which technological change will affect mining and extraction costs is unknown. Substitution among minerals may result from changes in relative prices and from technological change in industries using these minerals. Because of the highly speculative character of estimates of regional and world resource endowments, a very cautious and conservative approach was used in making the basic calculations for this study—namely, the available current estimates of reserves of minerals known to exist at present were used as a basic benchmark without any provision for new discoveries or major new potential sources, such as undersea nodules.

When measured against this extremely conservative benchmark it was found that only two of the metallic minerals considered in this study, lead and zinc, are expected to "run out" by the turn of the century,

⁸ *Far Eastern Economic Review*, 23 January 1975.

provided that the assumptions of future demand are correct and that proven reserves of mineral resources do not increase from their current estimates. However, other investigators have expressed concern about adequacies of other minerals such as asbestos, fluorine, gold, mercury, phosphorus, silver, tin and tungsten.

In a less conservative scenario the estimated endowments of metallic resources found to be relatively scarce either in the world as a whole or in some of the regions were augmented by "hypothetical" and "speculative" reserves cited in geological investigations. In this variant, world reserves of copper were increased about 2.5 times, reserves of nickel 2 times, reserves of lead 1.5 times and reserves of zinc 1.2 times. Iron ore and bauxite were found to be in abundant supply.

Of the energy resources, coal is relatively plentiful even under conservative endowment estimates, while natural gas endowments furnish only a small proportion of energy for the developing countries. In the case of petroleum, available estimates of world reserves were found to be roughly 1.3 times the estimates of cumulative world demand through 2000. However, estimates of oil reserves are increasing rapidly, and it is very difficult to reconcile the various conflicting estimates of possible future changes in their regional distribution.

Thus, known world resources of metallic minerals and fossil fuels are generally sufficient to supply world requirements through the remaining decades of this century, and probably into the early part of the next century as well. However, the adequacy of the world endowment does not necessarily ensure against regional shortages and high prices, nor does it guarantee smooth economic transitions to dependence on shale oil, gasified coal and other "new" energy sources.

As far as regional distribution is concerned, it was found that in the absence of major new discoveries, Western and Eastern Europe, "medium-income" Latin America, arid Africa, and non-oil Asia will remain net importers of most basic minerals in the foreseeable future. Because of balance-of-payments difficulties these regions may have to consider mineral reserve exploration among their top priorities for economic growth. This is especially true of non-oil Asia and Africa, and parts of Latin America.

The study took into account the fact that even in some cases in which mineral resources were relatively abundant in physical terms they will be more costly to extract in the future. As the more accessible reserves of particular minerals become exhausted, the next layer involving higher extraction costs begins to be exploited. To some extent this can be modified by increasing the efficiency of mineral extraction and by new discoveries of highly productive reserves.

Thus, the general response to the question posed earlier is that mineral resource endowment is generally adequate to support world economic development at relatively high rates but that these resources will most probably become more expensive to extract as the century moves towards its conclusion.

Conditions of growth (III): economic cost of pollution abatement

Any scenario of accelerated economic development has to deal with the problem of rapidly increasing pollution, which accompanies the growth of industry, transportation, urban agglomerations and even technical

progress in agriculture. It is felt in some quarters that in the long run, and most certainly before the turn of the century, this would lead to insurmountable physical constraints on any further economic growth. The two most pertinent questions in this respect are (1) whether the growth of pollution is at all avoidable and (2) whether the costs of pollution abatement are too high and present a significant constraint on resources for consumption and investment.

The answer to the first question is by now pretty obvious: for many types of industrial and urban pollution, technologies are currently in existence which make it possible to significantly reduce the actual emission of pollutants to at least manageable levels.

The present study estimates, on a world-wide basis, and for each region separately, the future emission of some of the major pollutants: particulate air pollution, biological oxygen demand, nitrogen water pollution, phosphates, suspended solids, dissolved solids, urban solid wastes and pesticides. Abatement activities represented in the study consist of the commonly recognized treatment for particulate air pollution, the primary, secondary and tertiary treatment of water pollution, and the land filling or incineration of urban solid wastes.

Not all the pollutants that are treated by currently used abatement processes are completely abated. For example, processes for the elimination of airborne waste leave unabated around 1 per cent of the pollution in the treated pollutants, and in the case of water pollution 20 per cent of suspended solids. Although the concern for the impact of pollution on the environment has led to rapid technological progress in the abatement processes, for many pollutants, such as sulphur, nitrogen oxides, carbon monoxide and hydrocarbons in the case of airborne waste, pesticides and manure-waste dumping, agricultural pollutants and radioactive waste, no abatement processes are as yet commercially available. Owing to the lack of necessary statistics, the study did not attempt to cover the very important problem of pollution of the open seas. In spite of these limitations, the scope of this study lays the basis for a generalized economic analysis of the problem.

As in the case of minerals, a very cautious and conservative approach was followed. The 1970 standards of pollution abatement in the United States of America were used as a general yardstick, and four hypothetical scenarios were applied for current and future periods, according to the following rule: in any region with a *per capita* gross product of more than \$2,000 (1970 constant dollars) the 1970 standards of the United States would have to be fully applied. In other words, these regions would first have to abate pollutants in the same proportions that they were abated in the United States in 1970, and then they would have to increase their abatement activities in such a way as to keep net emissions of pollutants at the level established when the full 1970 United States standards were first applied. The regions falling into this category for the whole period under study are North America, Western Europe (high-income), Japan and Oceania. For these regions it is assumed that pollution will not get worse, in absolute terms, than it was in 1970, if United States standards are universally applied. Any absolute reduction in net pollution emissions would be contingent on better abatement technologies and higher abatement costs.

For regions in the \$700 to \$2,000 *per capita* income bracket, which in 1970 included all other developed and

medium-income regions, it was assumed that the proportion of pollutants abated would have to be equal to half of the United States proportions in 1970. According to the study, two of these regions—namely, the Soviet Union and Eastern Europe—would reach the United States abatement standards by 1980; in the other regions concerned, progress in pollution abatement would be significantly slower.

For regions with a gross product of less than \$700, no abatement was envisaged. This was based on the assumption that pollution does not, as a rule, present serious problems at the stage of development in question, except for certain industrial areas and urban centres, and that, on the other hand, such countries would be the hardest pressed as far as resources for investment and consumption are concerned.

In 1970 all of the developing regions in the study fell into this purely hypothetical "no-abatement" category. It was found that some of them, like parts of Latin America and the Middle East and African oil countries, would have to introduce pollution-abatement activities as early as 1980. However, it was thought that in non-oil Asia and Africa the "no-abatement" scenario would remain well into the next century. The net emission of pollutants in these regions would, of course, increase more or less in proportion with their gross products and even faster, posing relevant problems for policy makers.

The study goes on to measure the costs of maintaining these relatively conservative abatement standards. For regions in which the maximum standards of abatement were applied, total costs (including investment and current costs) of abatement procedures included in the study, amounted to 0.7-0.9 per cent of gross product. Since the study, thus far, covers only about one half of actual abatement, according to current United States standards, the total costs of all abatement activities would be in the area of 1.4-1.9 per cent of gross product. This is consistent with available estimates of national expenditures for pollution abatement and control in the United States of America—about 1.6 per cent of gross national product in 1972.⁹ Where more liberal abatement standards were applied, the total costs of all abatement activities would amount to 0.5-0.9 per cent of gross product. Thus, a developing country contemplating pollution-abatement activities would have to consider diverting one half to one per cent of its gross product from consumption or investment in production facilities.

The share of capital stock used for abatement purposes is estimated by the study to be in the area of 2.5 to 4 per cent for full coverage of the abatement activities considered. The actual estimated private investment for pollution abatement in the United States of America was about 5 per cent of total private expenditure for new plant and equipment in 1973-1975.¹⁰ Public expenditures for pollution abatement and control would have to be added to this estimate to make it more comparable with the findings of the present study.

For developing regions planning a limited implementation of pollution-abatement techniques, a realistic estimate of the share of investment diverted from other purposes would not, on the average, be larger than 2 to 4 per cent.

Thus, the findings of the study are that although pollution is a grave problem for humanity, it is a technologically manageable problem, and that the economic cost of keeping pollution within manageable limits is not unbearable. This does not mean that in the future the world can avert all environmental disruption at moderate cost, or that even modest levels of abatement expenditures may not be considerable, particularly for countries that are just entering the intermediate stages of industrialization. What it means is that the pollution and pollution-abatement problem does not pose an insurmountable barrier for accelerated development along the lines considered in the study.

Conditions of growth (IV): investment and industrialization

The study points to other significant problems of resource allocation which accompany the path of accelerated development. Stepped-up rates lead to a substantial increase of the share of investment in gross product and in the share of producer goods in total output. As shown in the study, the ratio of gross fixed investment to total final internal use (sum of investment, private and public consumption) would need to increase from 20 per cent on the average in 1970 to 41 per cent in 2000 in the Middle East and African oil countries, from 17-20 to 31-33 per cent in Latin America, and from 15 to 23-25 per cent in non-oil Asia and Africa.

The proportion of gross product devoted to investment depends on the rate of growth and pattern of gross product and the coefficients relating the stock of capital in the form of plant, equipment and inventories to the level of production by economic sector. It appears from the calculations in this model that growth rates of 4-6 per cent can be accomplished with an average investment ratio of 20 per cent or less. Growth rates of 7-8 per cent point to investment ratios of about 30 per cent, while sustained growth rates of 9-10 per cent or more cannot be accomplished unless the investment ratio goes up to 35-40 per cent. These ratios are far in excess of the minimum 20 per cent target recommended by the International Development Strategy for the Second United Nations Development Decade.

Current rates of total savings in the developing countries can be augmented at least to a limited extent by reallocating to saving and investment channels some of public consumption in countries in which the rate of public consumption currently allocated to non-civilian purposes is too high. However, because of high demand for public expenditure for various civilian purposes (i.e., education, health services, social security etc.), a large part of the reallocation for investment will have to come out of private consumption. The share of personal consumption expenditure in total final internal use will probably have to be brought down from 68-71 per cent in most developing regions in 1970 to about 60 per cent in non-oil Asia and Africa, to 55-57 per cent in Latin America, and close to 50 per cent in the oil countries of the Middle East and Africa.

The relative decline in the share of personal consumption would lead to an initial slowdown in the increase of *per capita* consumption. However, this disadvantage would, within the period under investigation, lead to much higher levels of both personal consumption and

⁹ *Survey of Current Business*, February 1976, p. 8.

¹⁰ *Survey of Current Business*, July 1975, p. 15.

per capita consumption through faster growth of total production than would be possible with lower ratios of investment.

The study shows that currently prevailing private and public savings would be clearly inadequate to finance the necessary levels of investment. Substantial relevant measures of taxation and credit and monetary and fiscal stimulation of savings will have to be taken, and institutional changes made, facilitating an accumulation of resources for investment and directing them into those sectors which are essential for the process of accelerated development. Active policy in the investment sphere is desirable, including the setting of investment priorities and the increase, where necessary, in the role of public investment and of the public sector in production and in the infrastructure of the economy.

Special measures would have to be taken to facilitate a more equal distribution of income in the developing countries, so that the benefits of faster growth of average *per capita* income are shared fully, and on a priority basis, by the poorest groups in these countries. Government action may be needed to see to it that high private earnings derived from accelerated development are directed more and more into equitable and productive uses.

As shown in the study, agriculture and extraction will be expanding at slower rates than total gross product once over-all growth is higher than 4 per cent per annum. At the same time, total output of manufacturing industries is expected to expand at higher rates than gross product—namely, 6-7 per cent in non-oil Africa, 7.5-8 per cent in non-oil Asia, 8.5-9 per cent in Latin America, and 14 per cent in the oil producing countries of Asia and Africa.

One distinctive feature of industrialization in the developing regions is the generally lower growth rates of light industry, when compared to those of heavy industry, including machinery equipment and industrial materials (i.e., steel, rubber, chemicals, etc.). This general rule, as shown in the study, is a logical consequence of the growth of the investment ratio and of the decline in the share of personal consumption in total final use.

The tendency of heavy industry to grow more rapidly is well pronounced in all developing regions, according to the study. Growth rates of this sector would reach 7-8.5 per cent in non-oil Africa, 8-8.5 per cent in non-oil Asia, 9-10 per cent in Latin America and 16-17 per cent in the oil countries of Asia and Africa. An accent on heavy industry is essential for industrialization and economic development on the broad regional, though not necessarily on the small country, basis. This opens vast horizons for co-operation and specialization between developing countries, especially in the priority sectors of machinery, equipment and basic industrial materials. The study also shows that because of its substantial current share in total industrial production, light industry in many cases will still remain a larger part of manufacturing than either equipment and machinery or industrial materials in the period before 2000.

The changes in the industrial structure of the various regions reflect their differences in mineral resource endowment, as well as the relative difficulty of developing machinery and equipment as compared to industrial materials production. However, a much larger share of domestic machinery and equipment production would be necessary if the developing regions were to drastically reduce their current dependence on this category of imports.

Changes in world trade and potential payments gap

The study goes on to discuss the implications of accelerated development for international economic relations. Under the most favourable scenario analysed in the study, the share of developing market regions in world gross product would increase from 11 per cent in 1970 to 22 per cent in 2000; their share in world output of manufacturing industries, from 6 to 17.5 per cent.¹¹ If the countries of Asia with centrally planned economies were added to the developing market regions, the changes in the shares would be from 15 to 28 per cent in gross product and from 9 to about 24 per cent in manufacturing output.

According to the study, the countries with centrally planned economies as a whole would increase their share of world gross product from 23 to 27 per cent and of world manufacturing output from 22 to 29 per cent, while the shares of those with developed market economies (including medium-income regions) would fall from 66 to 51 per cent of gross product and from 70 to 49 per cent of manufacturing output. Though the overall redistribution of product shares in the coming decades would be substantial, the changes in shares would not involve any absolute reduction either in product or in *per capita* income of any of the developed regions. The redistribution of shares would be a natural outcome of different growth rates in various regions in the world in the course of their mutual co-operation in global economic development.

If the targets set by the International Development Strategy for the 1980s and historical trends were used as a basis for extrapolation into the future, the total share of developing countries (both those with market and centrally planned economies) in the world gross product would reach 22 rather than 28 per cent, and in manufacturing output 17 rather than 24 per cent. For the developing market regions as a whole the shares would be in this case 16 per cent of gross product, and 11-12 per cent of manufacturing output. Even these increases would be significant when compared to the relatively small changes in shares which occurred during the previous 30 years.

Continued world economic growth will lead to a brisk expansion of international trade. According to the study, the total physical volume of world trade, measured in 1970 prices, would increase in 1970-2000 at an annual rate of 6.0 per cent. This is substantially higher than the average over-all growth rate of world gross product, 4.8 per cent. It is projected that in the year 2000, 14.5 per cent of world gross product would cross national borders as compared to 10.6 per cent in 1970.

There would be a particularly rapid expansion of trade in manufactured goods (about 7 per cent per annum), while growth in agricultural trade (at 2.9 per cent) and in mineral resources (at 5 per cent) is projected to be less than the average for all trade. Estimated in 1970 prices, the share of manufactured products in total world trade turnover would increase from 62 per cent in 1970 to 79 per cent in 2000, the share of agricultural goods and minerals would decrease from 38 to 21 per cent.

¹¹ This may be compared with a target of 25 per cent for the year 2000, set at the United Nations Industrial Development Organization Conference on Industrial Development, held at Lima in 1975.

An accelerated rate of development would easily increase the share of developing countries in world imports. Assuming normal decreases in import dependence, the share of developing market regions in total imports of goods in the more optimistic scenario is expected to increase from 16 per cent in 1970 to about 31 per cent in 2000. However, their total share in world exports of goods is not projected to rise as fast, leaving a large potential trade deficit in some regions. All in all, by 2000 the potential balance-of-trade deficit of the developing market regions would amount to some \$67 billion, at price levels taking expected changes in relative prices into account. This over-all deficit, however, consists in part of much larger trade deficits for several resource-poor developing regions.

If current trends persist, only a rather modest increase in net aid flows to the developing countries could be counted on. The net capital inflow to the developing regions would increase substantially, but when debt service payments are accounted for, the net financial gain of the developing regions from capital imports would turn out to be very small.

The study then goes on to discuss two drastically different possibilities. One alternative consideration was to estimate world economic development under the assumption that the individual developing regions (with the exception of the Middle East and other major resource exporters) maintained fully balanced payment positions with the outside world (i.e., their balance-of-payments totals would be equal to zero), and that no drastic changes in the economic relations between developed and developing countries would occur. This alternative is examined in scenario A in Chapter VII. Another assumption inherent in this scenario is that full employment is maintained in the developed countries.

Under this scenario, as shown in the study, the average growth rate of gross product in the developed countries would be 3.9 per cent, and only 5.4 per cent in the developing countries, significantly lower than the target set by the International Development Strategy. Due to the difference in population growth rates, the income gap between the two groups of countries would, by the year 2000, remain roughly where it was in 1970.

Conditions of growth (V): towards a new world economic order

Another alternative is to try to close the balance-of-payments deficit of the developing countries by promoting significant changes in the character of economic relations between the developed and the developing countries. The study attempts to estimate the magnitudes involved in various changes that would help close the potential balance-of-payments gap of the developing countries. These changes include the following:

- (a) A faster change in relative prices of primary commodities vis à vis manufactured goods;
- (b) A decrease in the dependence of the developing countries on imports of manufactured goods;
- (c) An increase in the share of the developing countries in world exports of manufactured goods;
- (d) Larger aid flows;
- (e) Changes in flows of capital investment.

The study shows that on a purely technological basis and taking into account the relative scarcity of some minerals, the prices of natural resources would tend to increase, relative to the prices of manufactured goods,

in the closing decades of the twentieth century. Under the assumption of conservative mineral endowments the average relative prices of minerals would increase some 2.7 times between 1970 and 2000 and the average price of agricultural goods by 14 per cent, while the average price for manufactured goods would decline by 6.8 per cent. Prices of mineral resources in 2000 would be 2.9 times higher in relation to manufactured goods than they were in 1970, and agricultural commodities would be 1.2 times as expensive.

These price changes would take a long time to happen. Most of them would occur in the 1980s or the 1990s. When these slow price changes are accounted for, it turns out that the over-all balance of payments of the developing market regions would emerge with a surplus by 1990 but would have a deficit in 2000. However, the payments position of the individual developing regions would be very different. While the oil-producing countries of the Middle East, Africa and Latin America would have an over-all trade surplus of \$15 billion in 1980 and more than \$100 billion in both 1990 and 2000, all the other developing market regions would have an over-all deficit of \$18 billion in 1980, \$80 billion in 1990 and over \$150 billion in 2000.

A combination of factors in the first half of the 1970s has in fact brought about drastic changes in absolute and relative prices very much in advance of what would be expected according to the study. These movements have not been uniform. While the price of petroleum in 1975 was 4.7 times higher than in 1970 in relation to the average prices of final consumption in the United States of America, the price of copper fell by 35 per cent, and the price of wheat (in a bad crop year) increased some 90 per cent, which is much more than the study considers likely by 2000 (31 per cent). Because prices fluctuate widely in the short run it was unrealistic to use current commodity prices for computations. However, other fairly realistic assumptions were made to evaluate the impact of faster price changes on the balance of trade and payments.

It was thus assumed that the relative prices, as computed for 2000, already would be paid in international trade in 1980 and 1990. This assumption brings about significant changes in the balance of trade of the developing countries. Most of the difference is due to the 3.5-fold increase in the price of petroleum. The net addition to the balance of trade of the developing regions, as a whole, is \$57 billion in 1980 and \$36 billion in 1990. The balance of trade of the developing regions as a whole becomes positive in 1980, and increasingly so in 1990, but a deficit is in order for 2000.

Actually, the price changes assumed in these variants do not favour all developing regions. The Middle East, African and Latin American oil regions, and also the metallic mineral exporting region, tropical Africa, are the beneficiaries, achieving in some cases substantial export surpluses in their trade balances. However, non-oil developing regions, and also those that are not large exporters of metallic minerals—namely, most of Latin America and Asia—do not directly benefit from these changes and have to pay the higher prices for minerals, of which they are largely net importers. While this additional burden is already quite large in 1980, it would become very substantial by 1990 and especially by 2000.

One way of alleviating this additional burden would be to introduce a scheme, under which the oil-importing developing regions would be financially compensated for

the higher oil prices they have to pay. The study estimates that under such schemes, if generally implemented, some \$11 billion in 1980, \$22 billion in 1990 and \$58 billion in 2000 would be redistributed in favour of oil-importing developing regions, mostly in Asia and Latin America.

The study also estimates the foreign-income increases to the developing countries stemming from the implementation of international commodity schemes, under which the prices of some agricultural goods, of which the developing countries are substantial net exporters, and of mineral resources other than oil, are raised starting in 1980. The over-all effect would be an increase in the export earnings of the developing regions of about \$20 billion in both 1980 and 2000, and about \$30 billion in 1990. These increases would be rather smoothly distributed between various developing regions, excluding the Middle East and arid Africa. Most of the additional earnings would be due to higher prices of copper, iron ore and products of tropical agriculture.

With all of these price changes put into effect, the projected payments situation of most developing regions would be brought into balance in 1980. However, because of the acceleration of their development in the 1980s and 1990s in all of these regions, except the Middle East and tropical Africa, fairly large payments deficits would re-emerge by 1990, and especially by 2000.

Special computations were made to estimate the effects of changes in import dependence and larger export shares of those developing regions which are not at present richly endowed with mineral resources. In one of the scenarios (scenario M) ratios of import dependence were reduced in Latin America (medium-income), Asia (low-income) and Africa (arid) for a variety of manufactured goods—namely, textiles and apparel, furniture, paper, wood, chemicals, cement, glass and all categories of machinery and equipment. It was assumed that it would be possible to reduce their projected rates of import dependence by 10 per cent in 1980, by 18 per cent in 1990 and by 26 per cent in 2000.

At the same time it was asked what the result would be if the shares of these regions in total world exports of products of light industry increased by 10 per cent in 1980, by 22 per cent in 1990 and by 35 per cent in 2000. It was also assumed that Latin America (medium-income) would be able to substantially increase its share of exports of agricultural commodities. The total savings in the balance of trade of the three developing regions in question was estimated at \$8 billion in 1980, \$34 billion in 1990 and \$73 billion in 2000.

Additional advantages would accrue to the developing countries if developed regions increased their dependence on imports through policies directed towards general liberalization of their tariff and non-tariff barriers, and especially through preferential policies in favour of the developing countries. The strongest effect, however, would be produced by a combination of both liberalized trade policies in the developed countries and the increased competitive power of the products of the developing countries. The combined effect of both changes in relative prices and foreign trade policies would be to practically close the balance-of-payments gap of the developing regions which do not currently have large exportable surpluses of oil and metallic minerals.

The study also estimates the possible magnitudes involved in larger foreign-aid flows. It was assumed that gross aid flows from the developed countries in relation to their gross product would increase step by step from

their current levels. This increase would not be uniform but would reflect the different starting levels and *per capita* incomes of the various developed regions. Thus, the gross aid ratio would increase from 0.85 per cent in 1970 to 1 per cent in 1980 and 2 per cent in 2000 in North America. It would remain at its current 1.5 per cent in both 1980 and 1990 and increase to 2 per cent in Western Europe (high-income). In Japan it would be increased from 0.45 per cent in 1970 to 0.75 per cent in 1980 and 1.5 per cent in 2000. In the regions with centrally planned economies it would constitute 0.5 per cent in 1980, 0.7 per cent in 1990 and 2 per cent in 2000.

These measures would have the effect of increasing net aid flows to the developing countries by \$3 billion in 1980, \$15 billion in 1990 and \$47 billion in 2000. More than half of the increase would be canalized into non-oil Asia, with the remainder evenly distributed between Latin America and non-oil Africa. The over-all effect of the increases in aid would be lower than the effect of better trade policies.

Finally, the study undertook to estimate some hypothetical changes in the movement of capital. A better mix of capital flows to the developing countries (including a larger share of loan and portfolio equity investment versus direct investment) might help to create a more favourable atmosphere for such flows, both in the developed and developing countries, and would thus serve as a factor promoting the transfer of modern technology to the developing regions. It was assumed that under these conditions gross capital outflows from the developed market regions would increase by some 20 per cent in both 1990 and 2000, while the average rate of return on such investment to the developed regions would be reduced by 2 per cent so as to lessen the burden of debt service and foreign income outflows from these countries.

It was found that the total net effect of these changes in favour of the developing regions would be about \$7 billion in 1990 and \$18 billion in 2000. These increments are relatively small financially when compared to other changes discussed previously but would involve substantial transfers of technology and funds for investments. The total effect of the various measures discussed is roughly to achieve the balance-of-payments equilibrium in the developing countries even under conditions of accelerated growth. It should be stressed that these measures are dependent on significant changes in the current economic relations between the developed and the developing countries, which are called for by the resolutions of the General Assembly at the sixth and seventh special sessions.

Summary

The findings of this study can be briefly summarized as follows:

(a) Target rates of growth of gross product in the developing regions, set by the International Development Strategy for the Second United Nations Development Decade, are not sufficient to start closing the income gap between the developing and the developed countries. Higher growth rates in developing countries in the 1980s and 1990s, coupled with slightly lower rates in the developed countries (as compared to their long-term trends), would reduce, at least by half, the average income gap by 2000;

(b) The principal limits to sustained economic growth and accelerated development are political, social and