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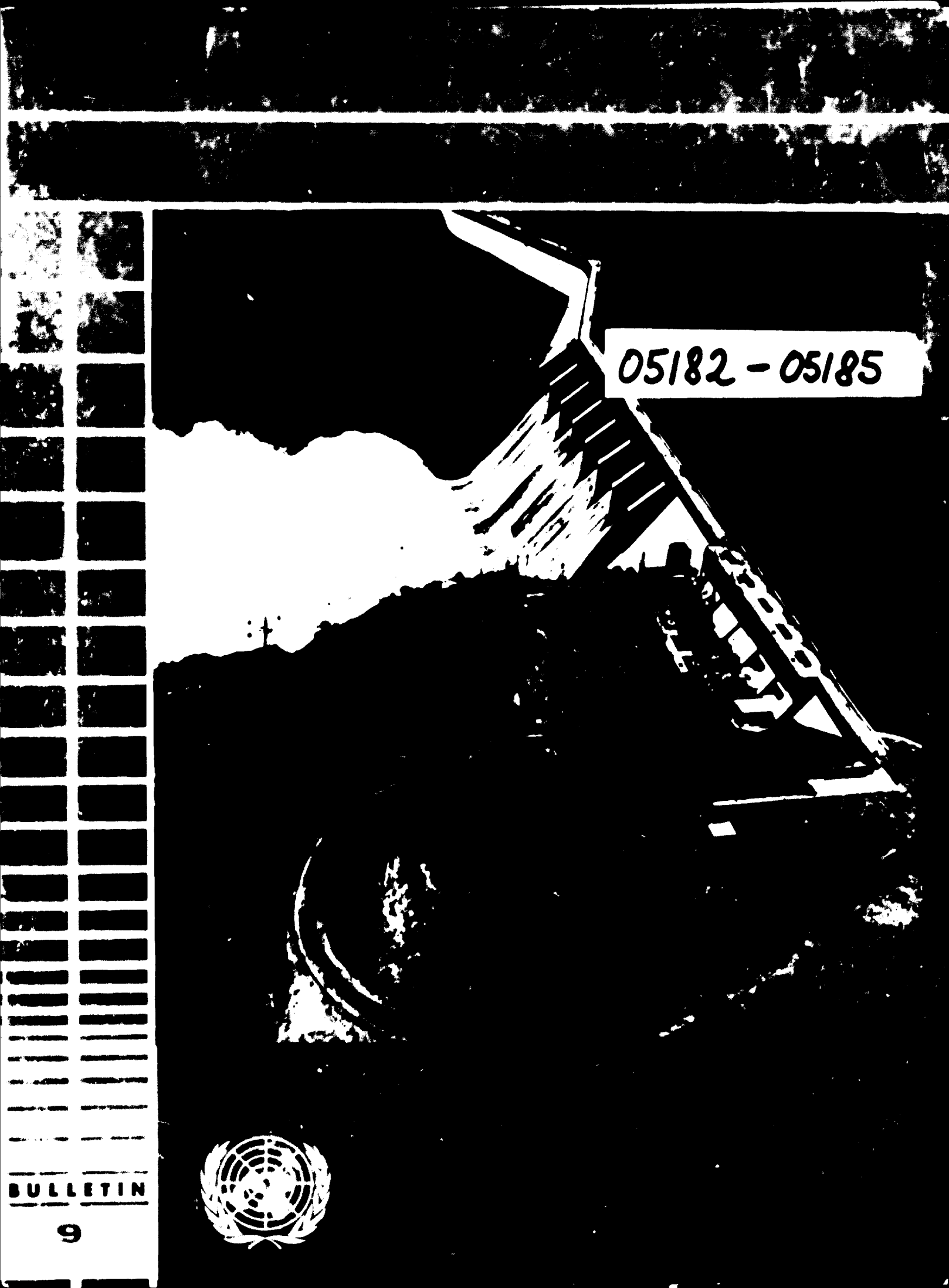

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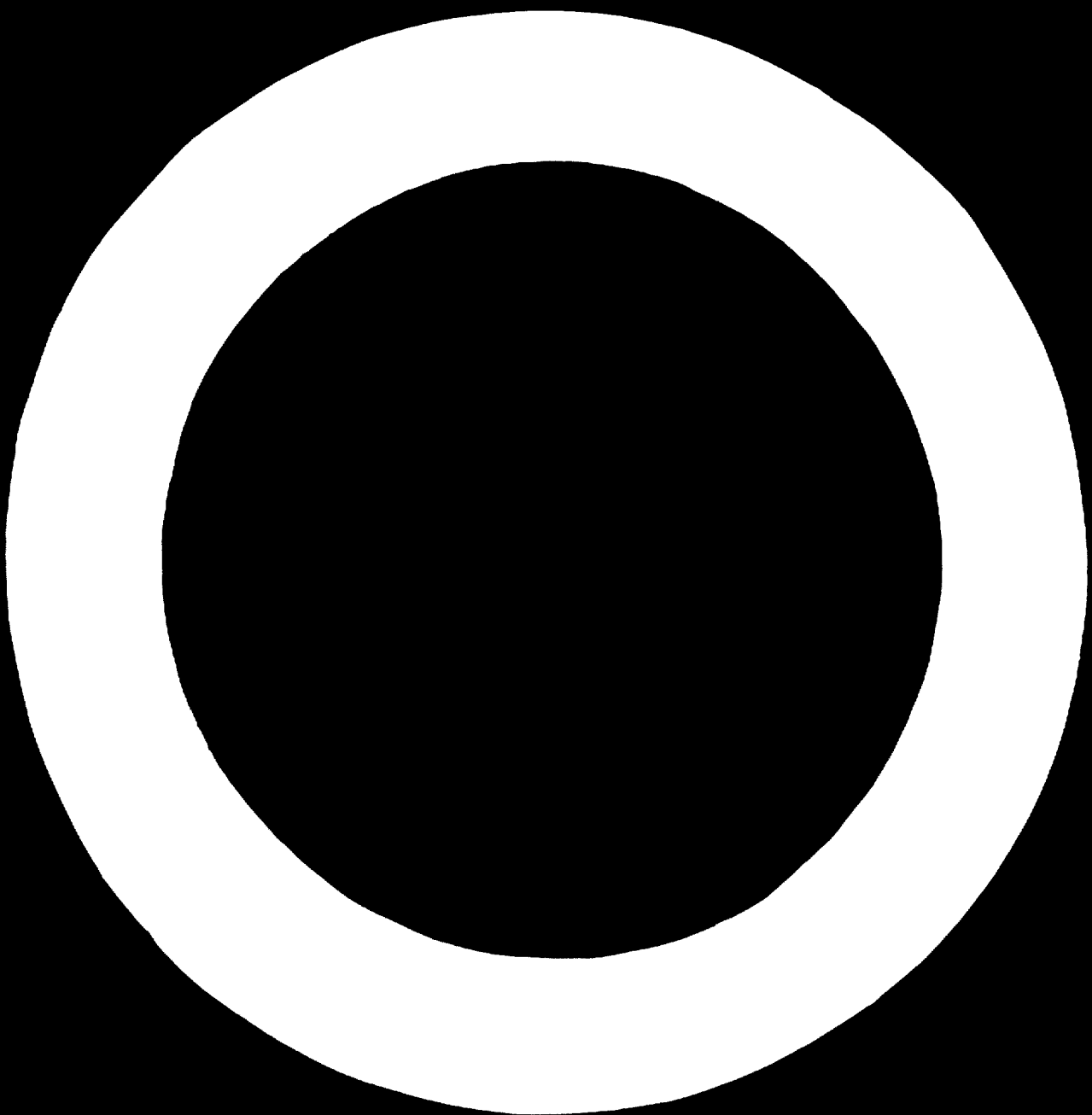

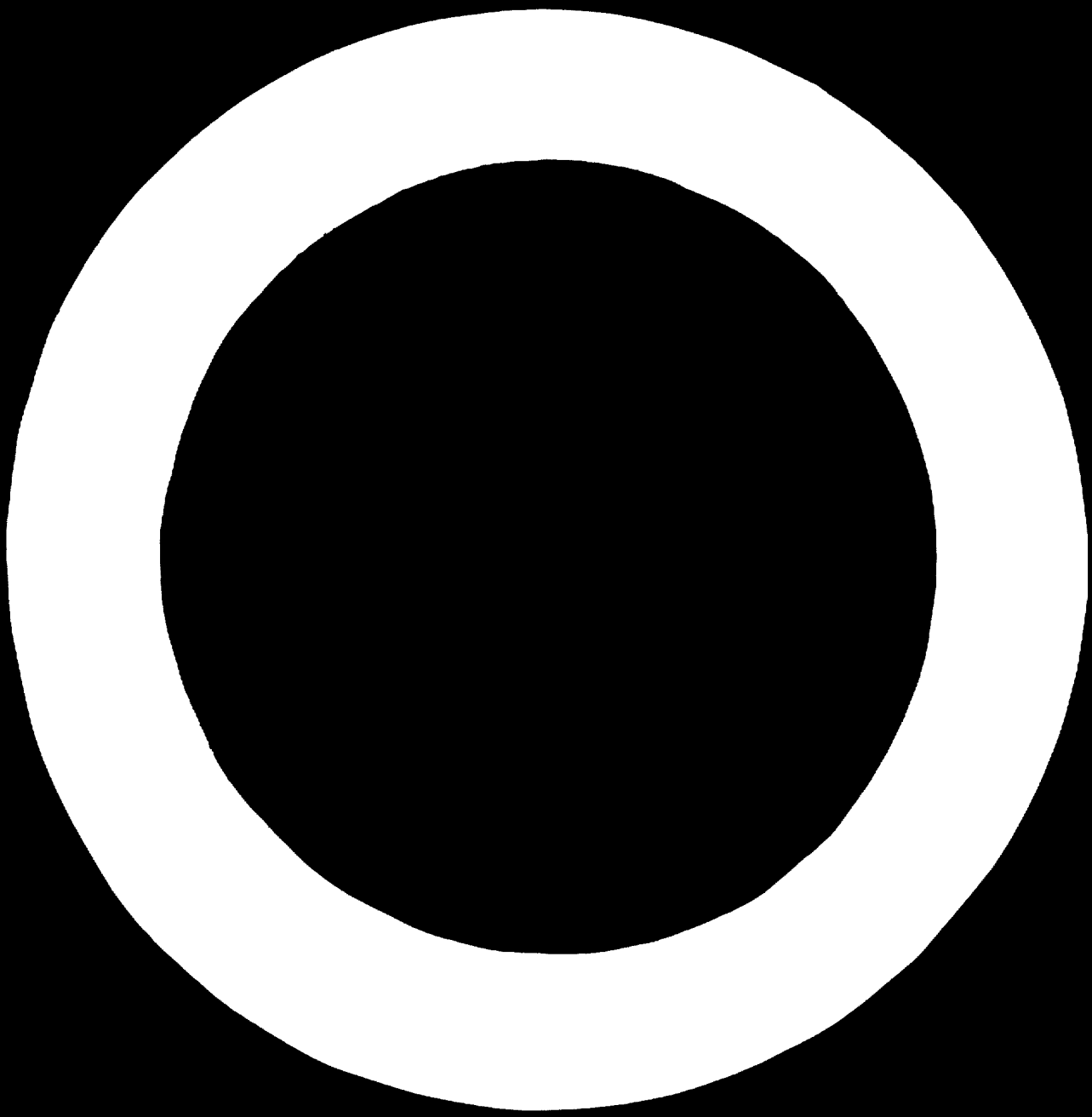

INDUSTRIALIZATION AND PRODUCTIVITY

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Cover illustration: The Rio Lempa hydroelectric plant in El Salvador. The photographs in this issue, which is largely devoted to problems of planning and programming, illustrate certain types of projects relating directly or indirectly to industrial development.

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Department of Economic and Social Affairs

INDUSTRIALIZATION AND PRODUCTIVITY

BULLETIN 9

UNITED NATIONS

New York, 1965

UNITED NATIONS PUBLICATION

Sales No.: 65.II.B.6
Price: $U.S. 0.75
(or equivalent in other currencies)

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Preface

Most of the contents of this issue of the *Industrialization and Productivity Bulletin* are devoted to planning and programming of industrial development, certain aspects of which were discussed in previous issues of this publication. The purpose of most of the articles published thus far was to contribute to the analysis of the methodology and technique of planning and the formulation of operational criteria to guide the selection, implementation and evaluation of projects. This general approach continues to be followed in two of the articles in the present issue — the second, which deals with certain aspects of the strategy of development planning, and the third, which is concerned with special problems of the methodology of programming.

In the first article of this issue, planning and programming are discussed from a standpoint not considered heretofore — that of the institutional machinery required for the preparation of national economic plans. The article "Organizational Aspects of Planning" is a comparative study of the types of agencies involved in plan formulation, their location in the government administrative structure, their internal organization, their policy making and technical functions as regards national and sectoral planning, especially the planning of industry, and the relationship of the planning bodies to implementing agencies and academic institutions. This article also deals with mechanisms for the participation of the private sector in the planning process in mixed economies.

In the second article, "Investment in Infra-structure *versus* Direct Production Facilities", Professor J. Pajestka discusses questions of the priority and extent of investment in economic overheads, especially transportation and power, and in productive facilities, particularly industry, as they arise in countries with different economic systems and at different stages of industrial development. Special attention is paid to the role of the public sector and of private capital in planning the volume of investment.

The third article, "Analysis and Projections of Consumption Demand: Methodological Notes", is concerned with methods of estimating and extrapolating parametric

constants, such as income elasticities and price elasticities, for projecting demand for household consumption goods (food, clothing, consumer durables and non-durables, etc.). Some crude methods of projecting demand for industrial consumption are also examined. This article discusses the comparative merits of alternative research techniques related to different types of data for studying the pattern of consumption demand. In view of the limitation of relevant data in the newly developing countries, the suggestion is made that information derived from the experience of more advanced countries may be utilized in planning development in the former; the article explores a framework in which the technique of inter-country analysis can be applied for such purpose.

The issue concludes with a note on a recent seminar on industrial estates in the region of the Economic Commission for Africa, which summarizes the seminar's main conclusions and recommendations.

Apart from the signed article, the material in this issue of the *Bulletin* was prepared by the Research Division of the Centre for Industrial Development, Department of Economic and Social Affairs.

Melting furnace at the copper smelting plant of Legnica, Poland

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Organizational Aspects of Planning

INTRODUCTION

Purpose of the study

In the years since the Second World War planning has been increasingly accepted and carried out in a large number of countries, countries with different social and economic systems and at varying stages of development. In some, it originated as an integral part of the social and political ideology; in the large majority it was introduced out of pragmatic considerations.[1]

Planning is being employed as an essential and strategic means of effecting government policy and activity with a variety of objectives. The primary objective is usually the initiation or acceleration of economic development; this is especially the case in many countries of Asia, Africa and Latin America, where the peoples' low levels of living and the rapid growth of the population are combined with high expectations for substantial improvements in material well-being in a relatively brief time. In these countries, planning is being widely adopted as imperative for realizing these aspirations. Sometimes the objective emphasizes specific related aspects: overcoming and eliminating chronic and persistent unemployment; diversifying and modernizing the economy; developing relatively backward regions in the country; correcting disequilibria in the balance of payments or in other sectors of the economy. Whatever the motivating force, it is based in each case on the recognition, implicit or explicit, that private initiative and market mechanism, if unaided and unguided, are inadequate tools for realizing these objectives and that the government has to assume responsibility either for providing such guidance and assistance or for taking over or supplementing the initiative of the private sector. Planning has thus emerged as an instrument for the effective mobilization and optimal utilization of available resources for attaining the desired goals of the national policy.

[1] The Soviet Union and other centrally planned economies are examples of countries where planning originated as an integral part of the over-all ideology. In a number of European countries, planning was initiated with a view to attaining rapid post-war rehabilitation of the economy and to utilizing effectively United States aid under the Marshall Plan. In the initial period, the plans of some countries, such as the Philippines and Taiwan, were prepared in order to be eligible for loans from the United States and the International Bank for Reconstruction and Development. In the majority of other countries, planning was adopted for the purpose of rapid economic development.

Planning in the modern sense was initiated in the Soviet Union in the nineteen twenties and in a few other countries, though only on a modest scale, in the nineteen thirties. During this pre-war period and in the first post-war years, planning in the mixed economies was confined mainly to the developed countries, as a means of preventing major disequilibria from arising and for preparing the transition from a war to a peace economy. It was only in the nineteen fifties that the emphasis in the science of planning was shifted to planning for the development of the less developed countries with mixed economies. Although the science of development planning for mixed economies is thus relatively young, considerable progress has been made in devising methods and disciplines for the formulation of development plans. In comparison, however, the equally important requisite of devising an effective administrative machinery for the preparation and execution of national economic plans has received considerably less systematic attention.

The present study deals primarily with the organizational aspects involved in the formulation of plans. Its purpose and scope were laid down by the United Nations Committee for Industrial Development which considered that sound arrangements for planning and economic programming in developing countries would facilitate effective decisions on policies of economic and industrial development and their implementation, and contribute to more effective international co-operation in the field of industrial planning and policies. The Committee therefore considered that the project on organizational aspects of planning formulated by the Secretary-General was of utmost importance and that it should examine the experience with various arrangements in different countries, not only in regard to planning proper, but also in regard to the collection and analysis of statistical information. The results of this study should provide governments with guidance in the setting up of their planning institutions.[2]

The institutional planning framework will largely correspond to the degree and nature of the planning and the stage of development of the country. Keeping in mind these broad distinctions, this study covers the location of the planning bodies in the government machinery,

[2] *Committee for Industrial Development, Report of the First Session, Official Records of the Economic and Social Council, Thirty-first Session, Supplement No. 2*, paragraphs 81 and 82.

their internal organization as regards the functions of national and sectoral planning, in particular programming and planning of the industrial sector and the relationships of the planning institutions with implementing agencies and academic institutions. It also deals with the mechanisms which provide for participation of the private sector in the planning process in the mixed economies.

Degree of planning in the public and private sectors

The economy of a country is generally divided into two principal sectors: the public sector, consisting of state-owned enterprises operated directly by departments of the government or indirectly through public corporations, and the private sector, comprising the rest of the economy. The private sector can be further subdivided into three subsectors: the corporate sector, the cooperative sector[4] and the independent producers sector. Planning, in principle, embraces the national economy as a whole, that is to say, it is based on an analysis of the requirements and possibilities of the total economy and is oriented towards its integrated development. Since the government has full jurisdiction over the activities of the public sector, it lends itself to direct planning in the form of investment programmes and construction and production schedules. The private sector, on the other hand, is less amenable to planning and has to be induced to perform the tasks assigned to it under the plan. The integration of the private sector in development planning requires the creation of a favourable climate through large scale public investment, suitable arrangements for associating the private sector in the formulation and implementation of the plan, regulatory devices such as industrial and import licensing, control of capital issues, allocation of important raw materials, and the like, technical and financial assistance and fiscal and other incentives geared to the priorities of the plan.

Both the public and the private sectors exist in varying proportions in all countries. For example, some 20 per cent of the gross national product is fully controlled and disposed of by the State in the United States of America.[5] On the other hand, a sizable market for agricultural products produced by independent producers and appropriate use of price policy and pecuniary incentives for labour and management are found in all centrally planned economies. "This brings us to two borderlands, where the proportion between public and private activity varies widely from country to country. In the first borderland, we meet the functions which some government perform because private enterprise fails to perform them sufficiently. In the second borderland are functions which private enterprise is anxious to perform, but which some governments prefer to reserve to themselves."[6]

The activities covered by the first "borderland" in developing mixed economies will include health services, education and the physical infrastructure (i.e. communications, transportation facilities, power supply, large scale irrigation facilities and water supply for industrial and domestic purposes). Health and education services are spending activities which the state has to undertake in any civilized country. Investments in physical infrastructure have three special features: they require an unusually large volume of resources, they have long gestation periods, and recoupment of capital is spread over a very long period. Individuals and private corporations, especially in developing countries, usually either lack the resources required for these investments or find them too risky and unattractive. Consequently, these investments are undertaken in the public sector.

It is also conceivable that a state, although pursuing in principle an ideology of private enterprise, may undertake and initially operate selected industrial, agricultural and financial enterprises, with a view to accelerating the pace of economic development at a time when the private sector is either not willing to perform these tasks or is incapable of doing so on account of uncertainties or insufficient resources or inadequate entrepreneurial experience and skill. The government would subsequently sell these enterprises to the private sector when the latter accumulates adequate resources and experience. "In Pakistan, for instance, the Industrial Development Corporation, which started its operations in 1952, has established more than fifty enterprises in both wings of the country. The Development Corporation has been able so far to hand over only about a quarter of their projects entirely to private ownership or operation. This proportion is low, partly because of the shortage of private capital and partly because of the unfamiliarity of some of the ventures."[6] Thus, the scope of the public sector may be temporarily expanded as a matter of expediency and in spite of ideological considerations in order to initiate and accelerate economic development.[7]

Investments in heavy industries deserve special attention in this respect. They share with investments in physical infrastructure two characteristics, namely, the large volume of resources required and the long gestation period. The construction and operation of enterprises in heavy industries call forth complex technical, managerial and entrepreneurial skills. Finally, these enterprises in the rapidly developing economies of the less developed countries have often to be undertaken on the basis of *anticipated demand* on account of the very long

[4] The co-operative sector is treated as a part of the public sector in countries with centrally planned economies.

[5] Professor John Kenneth Galbraith's address at the University of Bombay, 31 July 1951. (Official text, United States Information Service, New Delhi, page 3.)

[6] United Nations, *Measures for the Economic Development of Under-developed Countries* (Sales No. 51.II.B.2), page 17.

[6] Royal Institute of Public Administration, *Administrative Organization for Economic Development Conference Report* (London, 1959), page 98.

[7] The economic development of Japan offers an example of such circumstances.

gestation period involved in their planning and execution. The private sector, as noted before, is likely to be deficient in the skills and resources required for this purpose. But above all, entrepreneurship in under-developed countries may lack the foresight to anticipate the demand, or the anticipated demand may constitute too insecure a foundation to risk an investment involving complex technology, large resources and a long gestation period. Under such circumstances, the government may deem it necessary, for accelerating the pace of development, initially to undertake such investments in the public sector.[8]

The co-operative sector of the economy is frequently born out of necessity rather than choice as the best means of mobilizing the scattered resources of small producers and the effective method of helping them improve the quality and quantity of their output. Co-operative credit and marketing in agriculture and in cottage and small-scale industries, co-operative use of expensive machinery in agriculture and co-operative industrial enterprises and estates present examples of the co-operative sector being selected to aid producers, again independent of ideological considerations.[9]

Inadequate development of physical infra-structure and insufficient resources and entrepreneurial talent in private enterprises are common features of many developing countries. "Of one thing we can be sure as regards a developing country. A great deal of the work must go forward under public auspices. This is an imperative that is largely independent of ideology or political preference. In all countries, and not the least the United States, much of the initial thrust towards development has come from the state. And if private enterprise had been fully competent for the task in the presently under-developed countries it would already have asserted itself."[10] It is therefore evident that the public investment programme will occupy a central place in the development plan of any under-developed country. Moreover, the demand for goods needed for large scale public investment and, frequently even more so, the consumer demand resulting from the income generated in such investment will operate as powerful incentives to private enterprise.

Types of plans

Time period covered

Plans can be, in principle—and are in practice—elaborated for a wide range of time periods. For practical purposes, however, three main categories are conveniently distinguished according to the period covered:

Long term or perspective plans (ten years and over);
Medium-term plans (three to seven or eight years), and
Short term (annual or two-year) plans.

The basic objectives of economic policy, such as self-sustained growth, fundamental changes in the structure of the economy, reorganization of production on the basis of new and modern technology and substantial improvements in the levels of living of the population, take a long time to materialize. A strategy of development, based on the size and growth rate of the population, resource endowment of the country, balance of payments prospects (especially a potential for export promotion) and the stage of development, is elaborated to attain these objectives and is embodied in the perspective plan. The long-term plan covers a period long enough for the full effects of the deliberate actions aimed at attaining these basic objectives to be felt in the economy—frequently ten or fifteen years, sometimes as long as twenty or twenty-five years.

The long-term plans are split up into a number of medium-term plans. In some countries, medium-term plans are prepared without a long-term plan being elaborated; they are then based on a general idea of the desired direction to be taken by economic development. Although they are intended to achieve more modest results than the long-term plan, they are worked out in greater detail and constitute programmes for immediate implementation. The duration of the medium-term plan varies from country to country. It was originally five years in the Soviet Union, where "its rationale consisted in evening out of crop fluctuations during five-year periods".[11] However, crop fluctuations are less important in other countries, and the plan period is usually adjusted to the period of major investments in the investment programme; it accordingly varies from four to seven years in most countries.

Medium-term plans are usually broken down into annual or two-year plans to facilitate budgeting and for phasing and dovetailing the execution of projects.

Some countries have adopted the practice of the "moving" or "rolling" or "shifting" medium-term plan which is adjusted annually through the deletion of the current year and the inclusion of an additional year, so that the government has a complete medium-term plan in any given year. This arrangement adds flexibility to the plan by facilitating its revision in the light of experience acquired in the preceding year. A similar practice is sometimes followed in respect to the perspective plan which is remade on the completion of each medium-term plan by the incorporation of an additional medium-term plan.

Sectors covered by the plan

Five principal types of national economic plans can be distinguished according to the sectors they cover.

[8] The government may hand over some or all of these enterprises to the private sector later on after having established them and put them into efficient operation.

[9] For example, the British Colonial Administration introduced agricultural credit co-operatives into India in the first decade of the present century.

[10] Professor John Kenneth Galbraith, "Industrial Organisation and Economic Development", *Papers by Visiting Economists* (Colombo, National Planning Council of Ceylon, 1959), page 95.

[11] Oskar Lange, "The Tasks of Economic Planning in Ceylon", *ibid.*, page 79.

A comprehensive plan covering all sectors of the economy and mandatory for implementation on the government organs and other agencies is found in countries with centrally planned economies. This type of plan presupposes the absence of a (non-government controlled) corporate sector, maximum possible collectivization of agriculture and centralization of authority in the government. It would be impossible to implement such a plan without realizing these pre-conditions.

At the other extreme, a plan may consist of a mere forecast of trends accompanied by the recommendations on a few guide-posts of the government policy. The distinguishing feature of this type of plan is the relatively small significance of the public investment programme as a spearhead for economic development. It is more appropriate in planning for stability in a mature economy in which private enterprise satisfactorily performs the function of economic development. Such a plan cannot be an effective instrument in less developed countries which aspire to accelerate the development of their economies since it chiefly leaves the pace of development to the spontaneous forces of the market economy. The very fact that the level and pace of development are unsatisfactory in these countries is proof that these forces are inadequate for attaining accelerated development.

Between the two ranges of plans described above fall three types of plans in which the public investment programme constitutes the core of the plan. In the first category, there is a plan for the public sector only unaccompanied by any planning for the other sectors of the economy. In the next category, the plan for the public sector is combined with a mere forecast of activities for the other sectors of the economy. In the third category, the plan includes a programme for the public sector as well as a programme for other sectors of the economy, the fulfilment of which is ensured as far as possible by such means as fiscal, monetary and financial instruments, a system of controls and financial, technical and other forms of assistance by the government. These three categories of plans represent, in the main, consecutive stages in the evolution of planning within a country parallel with the acquisition of planning experience and the improvement of administrative machinery and statistical information, rather than a choice among independent policy alternatives. Most of the discussion in the sections below is centred around these three types of plans in mixed economies.

Apart from the five categories of plans described above, some countries have *ad hoc* plans with the limited objectives of developing a backward region or assisting a lagging sector of the economy or reorganizing a distressed industry in times of structural change or correcting the balance of payments position. Such plans may include the public investment programme as well as the use of various instruments of economic policy. These are essentially partial plans and are usually adopted in advanced economies.

Formal status of the plan

With regard to the formal status given to the plan once it has been prepared, different procedures are followed in the various countries. The plan may be incorporated into law for mandatory implementation by all parties concerned; this practice is regularly followed in countries with centrally planned economies.[12] It may be incorporated into law as a guide for action in the government's economic policies and practices. It may be discussed and approved by the legislative organs, as is the case in India. Finally, it may represent a declaration of policy intentions by the government with or without discussion in the parliament. Whatever may be the legal status, the sanction of the plan depends on the seriousness with which it is undertaken by the government and actively supported by the people.

[12] A similar status is frequently given in other countries to the annual implementation programmes of investment projects in the public sector.

REQUISITES FOR EFFECTIVE PLANNING

Institutional reforms

Development planning calls for economic institutions conducive to economic development, efficient administrative machinery, comprehensive statistical information and knowledge of natural resources. The national economic plan operates through and upon the economic institutions. For the successful execution of the plan, economic institutions should provide incentives and rewards for efforts, encourage savings, effectively ensure their mobilization and channel them into productive investments and disseminate knowledge among the people.

The need for reforms in the field of agriculture, which accounts for the major portion of the total labour force and is the single most important source of the national income in most under-developed countries, is increasingly recognized. The abolition of functionless intermediaries, security of tenure, fair rent and institutional credit facilities for basic consumption requirements and productive investment are important requisites for providing incentives to cultivators. The increase in farm output depends on improved farm practices and the use of new and better inputs such as fertilizers, improved seeds and implements and insecticides. The former is the function of the agricultural extension service, which should become a permanent feature of the institutional framework of the agricultural economy of all under-developed countries. "Even in the United States the agricultural extension service has long been a classic example of a non-market method of development policy in a progressive

Open-pit mining in the Bokare coal-field, Hazaribajh District, Bihar, India

and predominantly market-oriented economy."[13] The supply of new and better inputs can be arranged through the extension service or through co-operative agencies. Should this task be entrusted to private agencies, great care will have to be taken to ensure the quality and regulate the prices of these inputs.[14]

The institution of the joint-stock corporation (or company) occupies a key position in the development of modern large-scale enterprises. The corporation enables the entrepreneur to mobilize small and scattered savings in large-scale enterprises which require large amounts of capital beyond the means of a few individuals. On the other hand, it helps individuals and institutions to invest their savings without being burdened with management and enables them to limit and spread their risks. One of the principal merits of the corporate institution is that it retains a large share of its profits for reinvestment and thereby renders a considerable proportion of its resources independent of the individual shareholder's propensity to consume. Reinvested corporation profits thus take on the form of involuntary savings. The importance of this factor is seen in the fact that retained earnings—depreciation allowances and retained profits—account for seven-tenths of the total investment in such industrialized countries as the United States of America and the United Kingdom.

The growth of the corporate institution requires appropriate legislation (company law), firms of auditors and a government department to administer the legislation, and for its effective operation, the corporation needs an integrated capital market comprising stock exchanges, issue houses, underwriting firms, a banking system, etc. Stock exchanges provide liquidity to the investors and need to be properly regulated for healthy trading in securities. Issue and underwriting houses perform the task of placing shares and debentures on the market, where they gain in marketability and appeal to the larger segment of investors. In cases where the shares are underwritten, the corporation is able to obtain the necessary funds for its operations even if a portion of the securities

[13] Ragnar Nurkse, *Patterns of Trade and Development* (Stockholm, 1959), page 42.

[14] For further discussion on agrarian reforms, *see* United Nations, *Land Reform: Defects in Agrarian Structure as Obstacles to Economic Development* (Sales No.: 51.II.B.3).

is not absorbed by the market at the time of flotation since the underwriters take over the unsold portion and dispose of it over a period of time.[15] Government-sponsored development corporations or banks may undertake the business of issuing and underwriting securities until such time as private houses are formed to take over these functions.[16]

Commercial banks are an indispensable source of short-term finance to corporations; they can also be employed to provide a part of their long-term finance by means of revolving or rolling short-term credit, suitable changes in the reserve requirements and the provision of rediscount facilities.[17] However, insurance corporations, provident funds and pension funds are potentially the most important sources of long-term finance for large-scale enterprises. Post office savings, savings banks and government bonds provide effective means for securing long-term capital in the public sector and are suitable for investors who prefer security.

Administrative machinery

Planning presupposes effective maintenance of law and order, well-defined laws governing contractual obligations and for the protection, acquisition and disposal of property, and a public administration that commands confidence in its honesty and integrity. In the absence of these pre-conditions, investment, whether public or private, is subject to the risks, uncertainties and eccentricities of public administration. It is idle to imagine that good development plans can be created or carried out without a government to do it.[18] In countries where these pre-conditions do not obtain, the first task is to build competent organs of public administration.

Development planning imposes on the public administration new and unfamiliar tasks which partake of the attributes of entrepreneurial and managerial functions. Time, which previously was not a very vital factor, suddenly looms large. While the administration, in discharging its traditional functions, is accustomed to time-consuming complex procedures, undue regard for forms and excessive centralization and slow tempo of decision making, its new tasks call for extensive delegation of responsibility, procedures designed to dispose of matters quickly and a rapid tempo of decision making. In addition, economic planning requires a wide range of technical skills generally not found in the traditional administration. It is therefore necessary to reorient the existing administrative machinery and expand it by the infusion of new technical skills. Although administrative talent is often recognized as an important scarce resource in under-developed countries, improvement and expansion of administrative machinery does not receive adequate attention from the planning authorities. Consequently, administration is hardly ever pre-planned and pre-designed and is always in the process of catching up.[19]

One of the principal factors preventing the effective deployment of the available administrative talent is the excessive centralization of decision making and details at headquarters (central ministries and cabinet secretariat). This compels key personnel to work excessive hours and to attend to very disproportionate transactions, which ultimately results in long delays in disposing of business. Excessive centralization may become a critical bottleneck in the rapid expansion of administrative machinery. This practice, inherited from pre-development economies, hampers the action needed to fulfil the target in accordance with the tight time schedule which is the essence of planning. Extensive delegation of responsibilities, precise definition of these responsibilities, the principle of individual responsibility and supervision of delegated tasks are essential factors in the administrative machinery geared to development planning. At the same time, there should be willingness to assume responsibility at the subordinate levels.

The quick tempo of development activities calls for personnel with varied and complex skills and necessitates rapid expansion of the administrative machinery through changes in its hierarchical structure. The enlargement of the number of hierarchical ranks, the increase in the number of personnel required in each rank and provision for their timely recruitment and appointment should be worked out at the formulation stage of the plan. The insertion of new subordinate levels in the administrative machinery will entail careful differentiation of responsibilities in decision making and actions at various stages of the hierarchy. Expanding the hierarchy also means expanding the organs performing given functions in proportion to the increase in their activities. In addition, there is a need for a disproportionate and collateral increase in staff at key higher levels in the pyramid of administrative structure to accelerate decision making and to expedite the functions of communication, co-ordination and supervision. "More and more officials —additional secretaries, joint secretaries, directors and managing directors—deal directly with ministers, thus providing ministers with broader perspective than communication with a single officer could provide and at the same time accelerating decision-making. The Secretary, consequently, is becoming more and more an aide to Cabinet, and aide to the Minister, and a co-ordinator

[15] Reserve Bank of India, *Report of the Committee on Finance for the Private Sector* (Bombay, 1954), page 94.

[16] The Industrial Credit and Investment Corporation of India, for example, performs these functions.

[17] *See* Reserve Bank of India, op. cit., page 45, and William Diamond, *Development Banks* (Economic Development Institute, International Bank for Reconstruction and Development, Baltimore, 1953), pages 44 to 47.

[18] Professor John Kenneth Galbraith, *Economic Development in Perspective*. Address delivered at the University of Madras, 19 July 1961. (Official text, United States Information Service, New Delhi, page 6.)

[19] *See* Economic Commission for Asia and the Far East, "Improvement of Administrative Machinery for Implementation", prepared by Indarjit Singh, Director, Organisation and Methods Division, Government of India, for the Conference of Asian Economic Planners, First Session, held in New Delhi from 13 to 15 September 1961 (CAEP.I/Country Paper 10), page 1.

and chief of staff among a group of equals or near-equals."[20]

Programme agencies in charge of execution of projects occupy a strategic place in the scheme of delegating responsibilities. In some countries, purchase of stores and all construction activity are centralized in the department of supplies and the department of public works, respectively. Similarly, all arrangements concerning personnel beyond certain ranks are controlled by the ministry of home affairs or interior which, in turn, is dependent on the public service commission for new appointments. These arrangements were originally intended to economize costs and maintain a certain level of quality of materials and men. However, they tend to become sources of delay leading to wastage of resources in periods of intense development when there is a great increase in the different categories of stores, types of construction works and range of skills required. Programme agencies require and should be given as much "self-contained power" as possible in respect of acquisition of land, purchase of equipment and materials, construction work and recruitment of personnel.

An important sequel to delegation is the progressive elevation of techniques of review and control of that which is delegated. "Inquiries into what has been done and what is being done, on a sampling basis, *replaces examination of everything proposed to be done*."[21] In some cases, it may be necessary to maintain a special staff to receive and digest progress reports, make field inspections, recommend remedial action whenever necessary and make after-the-fact inquiries into the propriety and efficiency of decisions and action. What needs to be realized is that it is neither possible nor desirable to have absolute control over anything done at subordinate levels: the control has to be exercised over the timeliness of actions and the underlying principles, rather than over a multitude of specific acts.

Development tasks, as noted earlier, require personnel with varied and complex skills. This calls for the introduction of new, specialized economic and technical services in the administrative apparatus. This step has recently been taken by the Government of India. The procedure of the public service commission designed for the recruitment of a handful of persons needs to be modified. A system of selection of individual appointees may be advantageously replaced in countries where development activities have gathered momentum by a procedure for the selection of a large number of eligibles and the maintenance of registers for them from which executive ministers and project administrators should be allowed to make expeditious appointments.

The efficient discharge of entrepreneurial and managerial functions at project or enterprise level calls for the introduction of at least four elements in personnel policy usually absent in the traditional administration. First, the personnel responsible for these functions should be recruited on the basis of their technical and business skills rather than on the basis of academic qualifications in the liberal arts. It may be added that the maximum age limit frequently imposed for entry into the traditional civil service has no place in recruiting these personnel. Secondly, salaries, pensions and other benefits should be commensurate with their responsibilities and with remuneration obtainable in the private sector. Failure in this respect may result in the inefficiency and loss of capable cadres to the private sector. Thirdly, it is essential to introduce the principle of evaluating the performance of these personnel by results rather than by formal compliance with detailed bureaucratic procedures. Finally, it is necessary to introduce a system of incentives and rewards for efficiency and disincentives for inefficiency. This means that (*a*) an incentive scheme linking remuneration with performance, applicable to technicians and other cadres in the managerial and supervisory ranks, should be drawn up and implemented and (*b*) provision should be made to remove and replace ineffective and inefficient personnel. The implementation of the system of incentives for efficiency and disincentives for inefficiency requires the establishment of objective criteria of performance, such as over-all and individual output and productivity, total and unit costs, standards of maintenance, sales and quality of products and profits and reinvestment. These criteria are highly developed and enforced as normal practice by modern business enterprises in the developed countries. They provide a reliable instrument for introducing the incentive scheme as well as for locating inefficient personnel.

Some traditional administrative procedures impede the timely performance of development tasks. One such procedure is the itemized reference of individual issues to superior authorities for clearance (approval, modification, comment or decision) and adherence to precedent in clearing proposals. There are a large number of issues for which it is difficult to find precedents at the time when a country is embarking on planned economic development. This results in considerable wastage of time and breeds the psychological tendency to wait for issues to arise and for their clearance from higher authorities. What is necessary is to classify the issues into certain types—preferably identifying the types in advance—and obtain from superior authorities a set of principles on which they can be settled and acted upon by subordinate authorities who should be encouraged to use initiative in deciding issues in the context of what is warranted under the given circumstances to realize the targets of the plan.

Multiple clearances are those where a proposed action requires the review, comment and approval of a number of departments in different ministries and often within the same ministry. Multiple clearances are indispensable where completion of a project or execution of a scheme requires the co-operation of a number of agencies. "But unless the procedure of multiple clearance of administrative decisions is well defined and co-ordinated, it can

[20] Professor Paul H. Appleby, *Re-examination of India's Administrative System with Special Reference to Administration of Government's Industrial and Commercial Enterprises* (Government of India, New Delhi, 1956), page 12.

[21] *Ibid.*, page 16; emphasis in the original text.

degenerate into a system of multiple delay and inaction."[22] Even apart from those cases in which the co-operation of other ministries is essential, in some countries many matters are referred for approval to other ministries which may be thought to have or which may claim to have some competing or impinging interest. This sets off the usual train of events—search for precedents, clearance from higher authorities and the like—in the ministries to which the matter is referred. It is hardly necessary to emphasize the importance of reducing to a minimum the number of matters on which other ministries are permitted to claim an interest.

In cases where construction of a project calls for co-operation from a number of agencies, the programme implementing agency should be given responsibility over as wide an area of action as possible. In the second place, the responsibility for co-ordination should be clearly defined and assigned to a special officer in the programming agency. Finally, the precise responsibility of each co-operating agency should be adequately spelled out. Only major issues should be dealt with by committee while maximum use should be made of informal communication—telephone conversations, for example—for settling minor matters. A system of flow charts showing the successive steps on which joint decisions and co-ordinated action are needed also helps to expedite the process of multiple clearance, as does the simultaneous servicing of all relevant documents among all the related agencies.

All proposals involving financial liability are cleared with the ministry of finance; these generally include detailed item-by-item expenditures. The enormous increase in expenditure under development planning makes it impossible to compete with this practice. The ministry of finance must delegate broad powers to other ministries and restrict its attention only to major liabilities. This must be combined with *post facto* random checking of minor items. Other ministries should also set up an internal expenditure control system. Secondly, the ministry of finance should issue its own check-lists for project estimates indicating what it considers to be sufficient detail for proper appreciation of financial liability. The other ministries should comply with these check-lists in submitting budget estimates. The major scrutiny of estimates should take place before the budget is submitted for approval and the period of pre-budget scrutiny should be extended. A time table should be agreed upon between the ministry of finance and the other ministries for submission and examination of budget estimates based on the check lists. Finally, the other ministries should be given permission to depart from the cost estimates submitted for the budget within defined limits; it will be practically impossible to submit accurate and precise cost estimates for projects which have never before been undertaken. The prior approval of the ministry of finance should be confined to substantial variations from the original cost estimates. These reforms are essential for speed and efficiency in developmental administration.

The reorientation of the administrative structure and procedures to meet the challenge of development is an integral part of planning. The speed of execution of any single project will be determined by the quality of the decisions reached at the formulation stage and not simply when work has been started on the ground.[23] Two types of decisions are involved—administrative and technical. Some of the issues relating to administration have been examined in this section. In view of the complexity of the tasks faced by the organs of public administration, it may be advisable to set up an organization and methods division in the cabinet secretariat which can become the focal point of administrative analysis. This agency can be charged with the duty of fact finding, analysis and making recommendations on questions of organizational structure as well as of methods and procedures.[24]

Statistics and surveys of natural resources

Statistics constitute the raw materials for economic planning. It is therefore indispensable gradually to build up a well-organized statistical system aimed at improving the quality and coverage of existing data and the collection of new data which should be required in formulating and executing the comprehensive, national economic plan. It is of the utmost importance to have at the outset a blueprint of a fairly complete statistical system to be developed in the future. Such a blueprint should be drawn up in the light of the principal gaps in existing statistics and of the relative priorities for obtaining the various missing series, and it should include an appraisal of the accuracy and usefulness of the data already available so as to avoid duplication as well as to improve the quality of the existing data.[25] The blueprint must be so phased as to enable better programming techniques to be adopted on the completion of each successive stage of planning.[26]

However, development planning cannot await the building of a comprehensive system of statistics. Any government can undertake a number of public projects. Statistical data required for some of these projects, such as schools, roads and small irrigation works, are available to the various government departments as a by-product of their normal administrative functions. Data for some

[22] United Nations, *A Handbook of Public Administration: Current Concepts and Practice with Special Reference to Developing Countries* (Sales No.: 61.II.H.2), page 101.

[23] Royal Institute of Public Administration, *Administrative Organization for Economic Development: Conference Report*, page 42.

[24] *A Handbook of Public Administration*, page 33.

[25] United Nations, "Statistics Required for Planning in the ECAFE Region", *Economic Bulletin for Asia and the Far East*, November 1955 (Bangkok), page 63.

[26] Guidance in respect to the series of primary statistical information to be covered by the programme can be obtained from United Nations, *Statistical Series for the Use of Less Developed Countries in Programmes of Economic and Social Development* (Sales No.: 59.XVII.10).

other projects can be obtained from consulting engineers or governments of other countries with similar environment which have executed such projects.

For statistical information to be adequate, it has (i) to be as accurate as possible; (ii) to cover all relevant data; (iii) to be presented in appropriate form, and (iv) to be available with the shortest possible delay. These criteria are in part mutually competitive; frequently, for instance, great stress is laid on completeness at the expense of accuracy and, especially, actuality. In the programme for improvement of statistics, care should therefore be taken to strike the right balance between the various desiderata.

Broadly speaking, it is possible to distinguish three stages of increasing complexity in programming techniques, representing the sequence in which they may be logically applied in practical planning; each subsequent stage will accordingly require additional statistical information. "The first step in development programming should be to determine the general rate of economic development which a country seeks to attain."[27] The data on national income, savings, investments, exports, imports, marginal and average capital coefficients and population (including age structure, if possible) over a period of several years in the recent past are needed for this purpose.[28] In the absence of any figures, it should be possible to obtain some indication of them from a study of comparable countries and careful observations of earlier data for more advanced countries. At a higher stage, "it is extremely important to distinguish the broad sectors of the economy and to plan the appropriate rates of development in those different sectors".[29] The additional statistics required at this stage include data on output, income, employment, price indices and wage rates, income and price elasticities of demand, labour productivity and capital coefficients for the main sectors of the economy.[30] The broad targets of the plan at both stages have to be translated into a programme of individual projects. For each project, data on costs and physical inputs needed in construction and operation are required. These include manpower requirements by categories of skills, quantity and quality of materials for construction, machinery and equipment, raw materials required for the operation of completed projects, foreign exchange requirements and the like. These statistics should be specific as well as in monetary terms.[31] Planning the development of a large number of sectors by means of input-output analysis (or inter-industrial analysis) and linear programming represents the highest stage of programming technique. Input-output tables, matrices of capital coefficients and of inputs of processes actually carried out and of possible alternative processes, and the demand function from domestic sectors and abroad of every sector's output are required at this stage of programming technique.[32]

Several items of statistics can be collected as by-products of normal administration procedures. These include data on large-scale industries, agriculture, including, landholdings, crop patterns, output, livestock, etc., and costs and material inputs for individual projects in the public sector. They must be collected by special statistical cells or bureaus in each ministry and department. Certain important statistical data for the economy as a whole, such as estimates of national income and related aggregates, population and labour force projections and annual censuses — of manufacturers, for example — should be collected and compiled by the central statistical agency. Finally, there is a need for data on consumer expenditures for estimating income and price elasticities of demand, statistics pertaining to small-scale industries, trade and services, labour force, under-employment, unemployment and the like in rural areas which can only be collected by periodic sample surveys. This is an important and complex task which should preferably be entrusted to an independent specialized agency. This agency could also be useful in carrying out any *ad hoc* statistical surveys required by the planning agencies. If necessary, it could also be employed to carry out independent checking of data collected by other agencies.

A high degree of centralization of responsibility is needed for defining the concepts, norms and standards to be adopted in collecting and presenting the statistics. This responsibility should be exercised jointly by the planning commission and the central statistical agency. The central statistical agency should also be entrusted with arranging in-service training of personnel and with the systematic improvement of the quality and coverage of statistics. Constant and systematic improvement in the quality of the data is imperative because planning demands a large quantity of statistical information at short notice, a fact which often adversely affects its quality. This need is reinforced by the continual refinement of concepts, procedures and methods that takes place in the science of statistics. An inter-departmental statistical committee would be useful for this purpose.

An exhaustive and reliable inventory of national resources is of great importance in planning, particularly of the natural resources of the country, such as deposits of ferrous and non-ferrous metals, coal, oil, etc. and hydro-power and irrigation potentials. Existing knowledge of the natural resources in many of the less devel-

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[27] United Nations, *Programming Techniques for Economic Development with Special Reference to Asia and the Far East* (Sales No.:60.II.F.3), page 8.

[28] *Ibid.*, pages 17 and 18.

[29] *Ibid.*, page 19.

[30] *Ibid.*, page 32.

[31] The United Nations Secretariat at Headquarters and the secretariat of the Economic Commission for Latin America are jointly conducting a study of pre-investment data for a number of industries. The study deals, for each industry, with the coefficients relating to investment as well as with operating costs, and it estimates these in their variation with the circumstances as regards the relative factor prices, size of populations, etc. It is expected that the first results of the study will be published shortly.

[32] *Programming Techniques for Economic Development with Special Reference to Asia and the Far East*, page 56.

oped countries is highly inadequate and is based on very rudimentary surveys; it is therefore necessary to establish at the earliest possible stage special departments for geological surveys and for surveys of hydroelectric and irrigation potentials. A detailed plan for the training of qualified personnel and for systematic and intensive coverage of the entire country for the purpose of these surveys should be formulated and carried out as a matter of great urgency.[33]

Similarly, systematic surveys of the soil composition of cultivated areas and potentially agricultural land provide the basis for the programme of diversification and rapid expansion of agricultural production which is, in general, essential both to meet the growing demand for food and to earn foreign exchange in a developing economy. Also, a systematic inventory of forest resources is necessary to ensure the preservation and expansion of areas under forest and to increase the output of forest products.

Aerial surveys play an increasingly important part in the preparation of inventories of natural resources of various kinds; they are especially relevant for the location of petroleum deposits. Some countries find it useful to establish a special agency for aerial cartography. The agency conducts the serial photography programme and the follow-up expeditions for ground exploration under the joint guidance of geologists, agro geologists, soil chemists and forestry specialists; it also prepares the maps for the various categories of users of the information obtained.

[33] Projects and training for surveys in the fields of natural resources lend themselves in many cases to financing with the assistance of the United Nations Special Fund.

THE PLANNING AGENCIES

A NATIONAL ECONOMIC PLAN comprises a consistent set of over-all targets for the economy—their implications on finance, taxation, foreign exchange, skilled labour, administrative machinery—and elaboration of projects and programmes at technical levels. Its preparation is the collective task of the central planning agency, the executive ministries, the central bank, regional planning agencies and other associated and advisory bodies. This section is devoted to the examination of these agencies in relation to the formulation of the plan with special emphasis on the central planning agency.

THE CENTRAL PLANNING AGENCY

The central planning agency is normally responsible for the preparation and, when appropriate, modification of the long-term, medium-term and annual economic plans. When planning is more diversified, the agency guides and co-ordinates it at lower levels. It is logically entrusted with preparing progress reports; also, the government usualy calls on it for advice on matters of day-to-day economic policy.

Policy making and technical functions

Plan formulation requires the defining of objectives, including the relative importance of competing objectives, the choice of instruments for the realization of these objectives, and the technical elaboration of the development programme. It is the task of the policy maker to define the objectives and the range of instruments which are considered politically feasible and appropriate. The function of the planning technician is a-political and consists of selecting the means for maximum realization of the chosen objectives within the scope of available resources and with the use of permissible instruments. The final approval of the plan pertains again to the policy maker.

At the earliest stage of development, the plan is confined to a limited number of projects in the public sector on acount of the scarcity of planning technicians and deficiencies in the statistical information and in the administrative machinery. At this stage, both functions may be entrusted to a single agency. This agency will also be called upon to make preparations for a comprehensive national economic plan at a subsequent stage, which will include streamlining the organs of public administration, arrangement for collection of statistics, training of personnel, etc. The following discussion will deal mainly with the structure and functions of the agencies at a more diversified stage of planning.

For the purpose of discharging its responsibilities adequately and effectively, the central planning agency may embody in its organizational structure two desirable features, namely, combining policy makers and technicians in a single team and preserving the autonomous character of the agency so that it does not become an adjunct of the government machinery or a battleground for the competing claims of various ministries and pressure groups. To some extent, these attributes are mutually exclusive and preclude an ideal solution. This necessarily implies a compromise solution, the efficacy of which primarily depends not on the letter of the constitution of the central planning agency but on the spirit which its personnel bring to bear upon their work. This emphasizes the importance of making the central planning agency a semi-independent advisory body.

Policy making and technical functions are sometimes entrusted to a single planning agency, which is semi-autonomous and acts as an advisory body to the government. To the topmost echelon of the agency, which is comprised of high-level policy makers and technicians, is attached a secretariat of technical personnel which works under their guidance and supervision. This arrangement springs in part from administrative convenience and in

A view inside a flour mill in Abidjan, Ivory Coast

A view of a section of the assembly line in a tractor plant near Córdoba, Argentina

part from the realization that planning and co-ordination are a continuing function. An additional reason for this arrangement in an under-developed country is that public investment forms a sizeable proportion of the total investment and the government is accountable for public expenditure to the legislature. An arrangement of the kind described obtains, for instance, in India where the Planning Commission comprises four cabinet ministers, including the Prime Minister and the Minister of Finance, as part-time members, and four full-time members at the technical level.

A few countries have preferred to establish separate, though closely related, agencies for dealing with policy making and technical functions. This arrangement is considered more appropriate in advanced countries where, as mentioned above, the plan consists of a forecast of trends accompanied by the recommendations on a few guide-posts of the government policy. In such cases, the technical planning agency may be an autonomous and independent body, while the policy making agency is, logically, a part of the government machinery.

However, in the majority of countries, there is only one central planning agency dealing exclusively with the technical aspects of plan formulation. This agency, which usually operates as a department of the government, obtains its policy directives from the cabinet, from the prime minister or president or, less frequently, from one of the other ministers.

Location of the central planning agency

The location of the central planning agency should be examined from the viewpoint of its task of co-ordinating the efforts of the various ministries and orienting the private sector towards the common goal. This suggests that it would be desirable to attach the central planning agency to the highest authority in the government. This, of course, refers to an agency which is either a semi-advisory body combining planning and technical functions or an exclusively technical organization forming a department of the government.

Locating the agency in the *prime minister's office* is, in fact, advocated on several grounds. "Where, in newly-developing systems of Cabinet Government, the Prime Minister is something more than *primus inter pares* he is the only member of the Cabinet able to cut across the territories of other ministers."[34] Secondly, it is reasoned that an important task of the prime minister is to co-ordinate the policy of the various ministries of the government and the task of the central planning agency is essentially one of co-ordination. Finally, the prime minister is the member of the cabinet with maximum authority and he is, at the same time, capable of viewing the interests of the nation as a whole rather than only the sectional interests of the individual ministries.

[34] *Administrative Organization for Economic Development: Conference Report*, page 40.

A 500,000-volt spark gap being completed in the Leningrad Proletari Works, Leningrad, USSR. The installation is designed to protect the Volga-Ural transmission line against overvoltage caused by lightning

The principal argument against this choice is that such a location will result in an excessive burden of work on the prime minister, who has many other important responsibilities to perform; an adequate solution to this problem might be to appoint as head of the agency a person of high calibre, knowledge and experience, assigning him to the highest possible level and thereby facilitating his independent action in all matters of planning. Another argument is that the arrangement will affect the prime minister's role as arbiter between ministers and bring him into the line of fire of the various pressure groups; however, since this will probably happen anyway, his prestige as an impartial arbiter may be increased if his decisions are based on the objective analysis and advice of the planning agency.

Several countries have adopted this arrangement or one similar to it: in Burma, Ceylon and Malaysia, for instance, the central planning agency is located in the *Office of the Prime Minister*; in Venezuela, in the *Presidency*; in Mexico, in the *Secretariat of the President*. It may also be attached in an advisory capacity directly to the cabinet or to such other high body as may exist, for instance, in countries with a federal government.

A few countries, including India, have a special ministry of planning. The reason for adopting this solution is that the task of development planning is of such paramount importance and so complex that it needs the full-time care of a separate minister whose attention is not continually diverted by pressing problems in the executive sphere. The drawback to this is that the political status of a minister is felt to be incompatible with the advisory capacity of the planning chief; that, moreover, as the exponent of objective planning, his influence as the government's "conscience" would be stronger if he were not on the same footing as the other cabinet ministers, where he can be outvoted by them. Also, it is felt that the planning ministry may tend to encroach upon the territories of the other ministries and strive to act as a super-cabinet. This again would violate the advisory function of planning and undermine the other ministries' sense of responsibility.

In other countries, like the Sudan, the planning agency is, formally or *de facto*, incorporated in the *ministry of finance*. Several considerations may be advanced in favour of this location. The ministry of finance scrutinizes the individual projects as part of its normal budgetary procedure and has, consequently, built up a body of expert experience for this job. It is argued that a separate central planning agency will duplicate this work, and that such duplication is undesirable in view of the shortage of expert personnel in developing countries. Moreover, since the purpose of planning is to provide for expansion within the limited resources of the economy, the central planning agency has to work in close liaison and co-operation with the ministry of finance, which alone is responsible for mobilizing and deploying the financial resources in the public sector and which is in charge of the monetary and fiscal policies—the most potent instruments for stimulating private investment. The major argument against this location is that the traditional role of the ministry of finance is one of control and conservation, which tends to make it a seat of conservative thinking, while the role of the central planning agency is expansionist in nature. The duplication of work argument, it is contended, reveals a confusion about the functions and nature of planning. The function of planning is to meet the challenge of development directed at overcoming unemployment and under-employment and at quickly raising the levels of living by telescoping a century into a few decades. It calls for mapping the strategy and direction of development and

A view of the shipbreaking yard at Jurong New Town, Singapore, designed with the assistance of a United Nations team. In the background is a 5,000-ton ship. About 85 per cent of the ship's tonnage is steel, which will be used in the adjoining steel mill.

laying down priorities, choice of techniques etc. This task is radically different from the scrutiny of individual projects carried out by the experts in the ministry of finance. Moreover, the function of financial control, tax collection, raising of public loans, etc., is big enough for a single ministry. Also, it is possible to work out satisfactory liaison and co-ordination by making appropriate arrangements other than actual incorporation.

The central planning agency is less frequently incorporated in *one of the technical ministries*. Such an arrangement can mostly be traced to historical rather than logical reasons.[35] The argument against this solution is that the other ministries will be inclined to consider planning as a private affair of the ministry in question and that the latter will tend to favour its own interests in the plan, such an attitude, whether justified or not, is bound to affect unfavourably the other ministries' willingness to co-operate actively in the planning.

Occasionally, the planning function is entrusted to the *central bank* or the principal *university*. The decision to favour such location appears to be based on the concentration of technically competent persons in these institutions. In theory, such an arrangement is supposed also to have the advantage of being free of current political events and pressure groups. However, it does not seem to be compatible with some of the basic principles of planning which have been discussed earlier. In the first place, the function of planning is essentially to prepare a basis for the government's policies and programmes; it seems inappropriate to entrust it to an agency outside the government's direct jurisdiction. In the second place, the plan should emerge, to the maximum extent possible, from the combined planning activity of all the ministries and other agencies involved, and should express their co-ordinated intentions and aspirations towards the common goal. An agency outside the government cannot be expected to be an effective instrument for activating and orienting these planning activities.[36] Also, the factors in favour of this arrangement can be realized along other lines: it is possible to assign technically competent personnel from the central bank or the university to work with a planning agency within the government administration on a temporary or part-time basis. Also, it is possible, through appropriate personnel policy and other measures, to go a long way towards affirming the advisory character of the central planning agency within the government and insulating it from the undesirable influences of current political events and pressure groups.

From the above discussion it is evident that for a central planning agency no one location is ideal under

*[illegible] the inside of the Central Statistical Estate. Modern [illegible] has made practical statistical methods a common [illegible] and [illegible] [illegible] [illegible]

Evaporation tests being performed at the research station of the Dead Sea Potash Works at Sdom, Israel

Internal organization

The aspects to be covered by a mature technical planning agency can be divided into two main categories, often denominated "horizontal" and "vertical", which can conveniently be grouped in corresponding technical divisions. The vertical aspects comprise the principal economic sectors: agriculture; mining; manufacturing industry; power production and distribution; transportation and communication; construction and housing and other personal services, and the government sector, which will include education, health services and the like. The horizontal, or general, aspects will include: income distribution and consumption; saving and investment; public finance; monetary equilibrium and banking; wages and prices; balance of payments problems; the labour force; employment and productivity, etc. Frequently, the general aspects division will comprise a steering or co-ordination section, under the direct supervision of the chief of division, which is at the same time responsible for the formulation of the various plans on the basis of the information obtained and the analysis carried out by all sections of both divisions. In case the planning agency is entrusted with the preparation of national accounts, input-output tables and other schemes of digested statistical information, these functions may be carried out by a special section in the horizontal aspects division, or a separate division may be established for the purpose. The same holds true for such items as those relating to the implementation of the plan, including progress reporting, co-ordination of regional planning activities and project evaluation. Sometimes it is felt convenient also to form a separate division for perspective planning and the analysis of structural problems, since the other divisions may, under the pressure of work, tend to neglect these fields. Finally, the agency will need an administrative division.

At the outset, the planning agency may comprise only a few technicians who take care, as well as they can, of all the functions and who operate with little formal structural organization. It will be advisable, however, to map out at an early stage a growth pattern for the organizational set-up against such time as the agency will have reached maturity.

The same holds true with respect to the staffing of the agency. It should be the general principle that the agency's staff members will be recruited on the exclusive basis of competence and integrity, and not from political considerations; this is essential for putting the agency on the desirable footing as regards its standing inside and outside the government. A full-fledged planning agency will comprise technicians with academic education in a variety of specializations, such as planning economists and econometricians, experts in input-output schemes and other fields of statistical analysis, financial specialists and lawyers, engineers, agronomists and other sector specialists, manpower and productivity experts, educationists and public health specialists, etc.

The effective operation of the planning agency as a complex whole of organically interdependent units requires well-conceived organizational devices. These will comprise schemes for periodic consultations between the director and division chiefs and between division chiefs and section chiefs, as well as *ad hoc* consultations for the co-ordination of activities relating to individual projects; the preparation of a strict time-table for the formulation of each plan or other study, etc. Special attention has also to be given to ensuring that information regarding data obtained be promptly channelled to all interested sections, and, particularly, that the latter be kept informed of any changes in these data.

Planning cells in executive ministries

The planning units in the executive ministries are responsible for providing materials for the aggregate plan relating to the various sectors of the economy in the form of project proposals and tentative sectoral plans and programmes; they also participate in the formulation of the final sectoral plans[37] and programmes within the scope of the aggregate plan. This two-way procedure of planning "from below" and "from above" will be discussed in somewhat greater detail in the following section.

These units play an important part in the process of planning, especially in view of their function as the channels through which the planning activity percolates within the executive ministries.[38] It is advisable that they be established at an early stage in the planning, starting with the most important ministries, and that each comprise perhaps only one or a few technicians to begin with. As in the case of the central planning agency, the

[37] The demarcation between aggregate and sectoral plans varies from case to case. In general terms, the aggregate plan formulates targets relating to such macro-economic items as the national product and national income, the balance of payments, etc. and specifies corresponding production and investment targets and resource allocations for the main sectors of the economy; the sectors' plans detail the latter by industries or crops and the programmes formulate the corresponding projects or groups of projects.

[38] When a ministry has jurisdiction over more than one of the main sectors of the economy — for instance, industry and commerce — it is advisable to establish separate planning units for each sector.

Road building in Guatemala

planning unit should preferably be given the highest possible level, which may, in this case, be the status of staff organ directly under the respective minister.

The ministerial planning cells should maintain close working relations with the corresponding sections of the vertical sector divisions in the central planning agency. The former will channel to the latter all information pertaining to the respective sector and relevant to plan formulation, as well as report on progress. Conversely, the central planning agency will transmit to the ministerial unit the directives concerning the respective sector resulting from the aggregate plan, and assist the latter in the formulation of its respective plans and programmes, the preparation and evaluation of projects and the preparation of progress reports.

The arrangement outlined calls for two sets of sector specialists, one in the vertical sector divisions of the central planning agency and the other in the ministerial planning cells. It is sometimes argued that this constitutes unnecessary duplication. However, on the one hand, it is essential that aggregate planning be carried out by a team to which is available expert knowledge relating to all aspects of the economy, including the vertical sectors, and, on the other hand, planning cells under the responsibility of the executive ministers are equally essential for effective planning, as discussed above. This does not preclude that, at the earlier stages and as a preliminary arrangement, the two functions can, in order to economize on scarce talents and funds, in some cases be assigned to one and the same person, who will then work part-time in the central planning agency under the responsibility of its chief and part-time in the ministry under the responsibility of the respective minister.

Regional planning agencies

Regional planning agencies are usually established in countries with a diversified regional economic structure.

A scrutiny of existing regional planning agencies reveals that they fall into three distinct categories. In the

first place, there are state or provincial planning bureaus in countries with a federal system of government. The distribution of powers provided in the constitution among the central government and the state or provincial governments will determine the scope and functions of the corresponding planning agencies in these countries. In the second place, the geographical complexities, especially the differences in soil and climatic conditions, and the dispersal of a vast number of producers over a large area, often necessitate the establishment of decentralized regional planning bodies for the development of agriculture and rural industries even in countries with a unitary system of government. Finally, special regional planning agencies are sometimes set up in river basin areas where considerable hydroelectric-cum-irrigation potential, frequently combined with sizable mineral deposits, provides a sound basis for rapid agricultural and industrial development.

Frequently, the primary function of the regional planning or development agency will be to explore and activate regional development possibilities and co-ordinate regional interests and aspirations, rather than to carry out the technical preparation of a regional development plan; the latter may be undertaken by, or at least with the active participation of, the central planning agency, which is in a position to compare the relative advantages of the various regions and construct the regional plans within the scope of the national development plan in such a way as to reduce, to the extent possible, excessive disparities among the regions. The agency may then comprise, in addition to a limited number of planning technicians, representatives of the regional governments as well as of the interested ministries of the central government, of the community development authority (in countries where such authority exists) and, sometimes, of the private interests. The technical element tends to be stronger, however, in some countries with a federal government where the states possess a relatively high degree of autonomy and wish to establish their own planning agencies with fully equipped technical departments. The same may hold true in the case of the planning agencies of river basin and similar authorities.

Non-official advisory bodies

Experience in several countries has affirmed the usefulness of associating competent non-official personnel with the formulation of the plan. Advisory bodies—panels, advisory or consultative committees and commissions—have been devised for this purpose. The rationale of these bodies is that consultations with non-official parties can yield valuable advice to the official agency responsible for the plan formulation, and at the same time help to secure greater public understanding and a feeling of joint responsibility for the plan, thus lending it a national character. The advisory groups usually meet a few times a year and advise on the matters referred to them or sometimes on matters brought up on their own initiative. The groups may be of a general nature, panels of economists and scientists, for instance, or they may be connected with such specialized fields as education, culture, land reform, co-operatives, scientific research and housing. Special bodies may be established to advise on matters relating to planning for important sectors of the economy, such as manufacturing industry, agriculture or transportation. In India, there are parliamentary consultative bodies made up of representatives of the different political parties with a view to securing non-partisan support for the plan. Important and technically complex projects involving considerable outlays (power and irrigation projects, chemical factories, engineering plants) may be referred to the bodies of consulting engineers familiar with them, for technical evaluation.

The Markala Dam on the Niger, at Segou, Mali, one of the largest dams in the world built exclusively for irrigation

Research and training institutes for development planning and related activities

Integrated development planning at the national level is a discipline of relatively recent formation. It is, in fact, still in the process of evolution: new approaches and methodologies are constantly being devised and existing ones refined and improved. The same applies to related fields, such as the more intricate forms of statistical analysis. All this requires extensive research. At the same time, professionals in these specialized fields have to be trained.

In many countries, universities as well as the planning agencies are active in conducting programmes for both research and training in the indicated fields. Sometimes, however, it is felt that the university programmes are not sufficiently operation oriented, and also that the planning agencies, as a consequence of the pressure of stringent dead-lines under which they are continually forced to work, cannot adequately take care of these tasks.

For these reasons, a few countries (India, the United Arab Republic, Venezuela, for instance) have established special institutes for the purpose, while in other countries (such as Afghanistan) such institutes are being formed. The institutes are usually governmental or semi-governmental and have a semi-autonomous status.[39] The institutes are not responsible for the actual planning, which is carried out by a central planning agency within or outside the government machinery. Their purpose is to engage in the activities mentioned earlier, that is, research as well as training for both development planning and higher statistical analysis. The activities in the statistical field may include training and research in the preparation of national accounts, of input-output tables and of the other devices of statistical analysis that were referred to in connexion with the statistical requisites for planning; they may also include projections.[40] The research programme in the field of development planning will preferably be formulated in conjunction with the central planning agency and be oriented towards the latter's specific needs. The training programmes are conceived to form general economic development planners and statistical analysts as well as experts in the related specialized fields. In addition, special refresher courses are being arranged for professional staff of the technical planning agencies, and seminars of short duration are being conducted for high government officials to acquaint them with the basic principles of co-ordinated development planning and policy.[41]

A regional economic development institute with similar objectives is being established in the region of the United Nations Economic Commission for Latin America (ECLA)[42] and others are under consideration in the regions of the Economic Commission for Asia and the Far East (ECAFE) and the Economic Commission for Africa (ECA).

[39] Institutes of the type described may, under certain circumstances, be eligible for financial assistance from the United Nations Special Fund.

[40] In Afghanistan, the Statistical Department of the Afghan Planning Institute will, on a temporary basis, act as the central statistical office.

[41] ECLA has been conducting courses of a comparable nature for several years. In Santiago, Chile, annual courses of six-months' duration (recently extended to eight months) are held, in which economists and engineers of academic formation are trained as general planners, sometimes with specialization in various fields. In addition, *ad hoc* intensive training courses are organized on a rotating basis in the countries of the region to familiarize high government officials with the principles of development and planning.

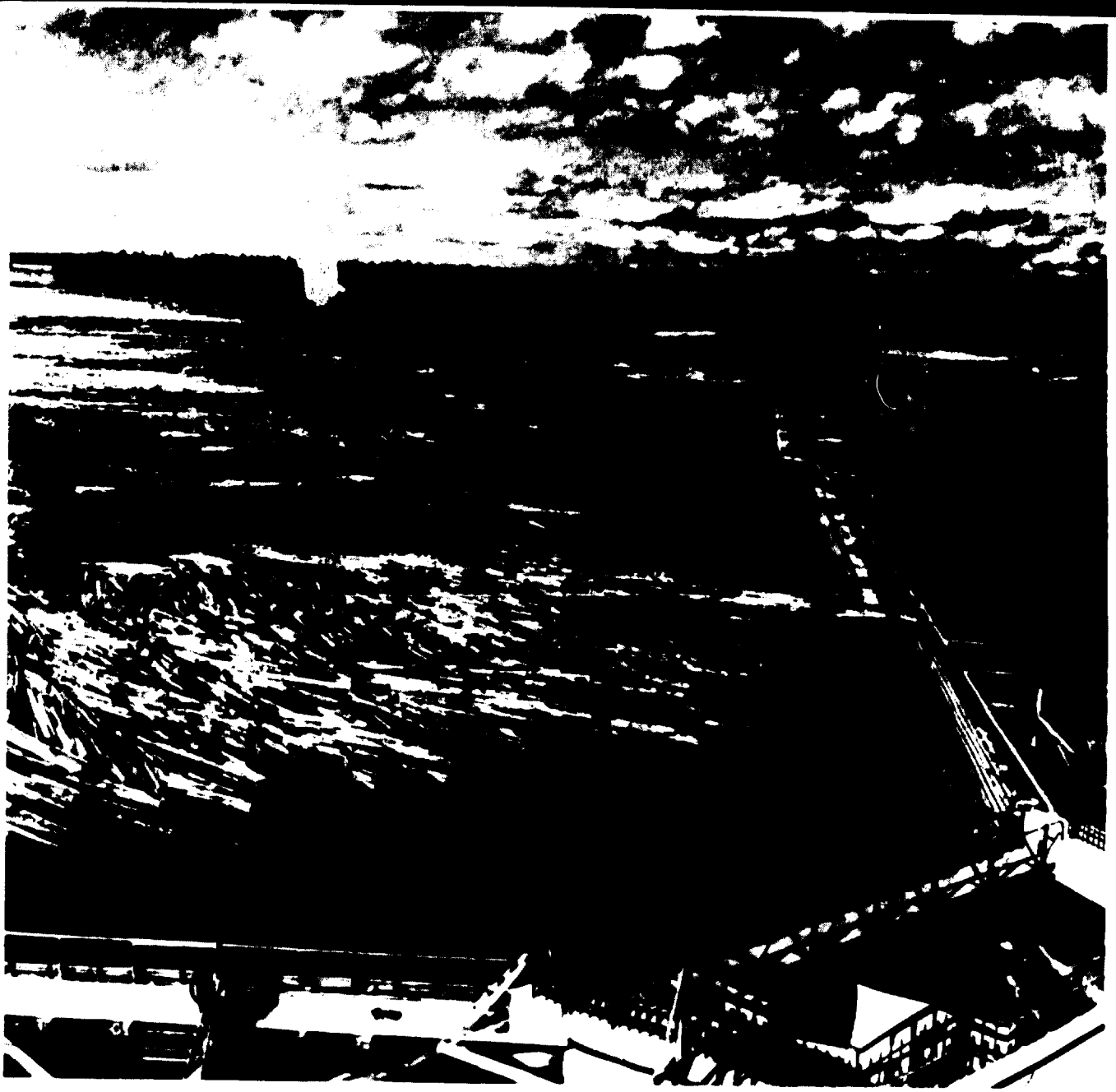
[42] The Latin American Economic Development Institute will take over from ECLA the courses referred to earlier as well as the research activities related to development planning.

PROCEDURES OF PLAN FORMULATION

The preparation of a plan embraces a considerable variety of activities: collection of statistical information, project proposals and provisional sector programmes and regional plans; computations involving a number of successive stages within the technical planning agency; consultations with ministries, planning commissions and, sometimes, the private economic sector, academic circles and technical experts; drafting of the plan and discussion of the draft with interested parties, and so forth.

The organizational aspects relating to some of these activities will be discussed in the following sections. At this point, however, should be stressed the importance of drawing up, at the start of the preparation period, a schedule of dead-lines for the various stages of work and of strictly adhering to it. Experience has shown that even with a strict time-table it requires a major effort to produce a plan on time; without one, this is virtually impossible. And, "It is much more important to have a certain document, if only in a provisional state, on time, than to have a more perfect document coming too late. Planning requires a thorough awareness of this truth and a marked degree of discipline and co-operation of the staff concerned".[43] It also requires a considerable degree of co-operation from the agencies —executive ministries, for example—on which the final elaboration of the plan depends. The time-table should indicate, among other things, the date or time period to which all the relevant information relating to the "actual" situation of the country's economy refers; the dead-line before which this and other information (concerning sectoral and regional plans, etc.) should be received by the central planning agency; the schedule for the internal work of this agency; the various rounds of discussions and consultations with other agencies, and so on. It is advisable to entrust one person with the responsibility of ensuring that the dead-lines are observed by all the parties concerned, within as well as outside the planning agency. This implies that each contributing party will have to devise its internal work programme in such a way as to deliver the best possible product within the available period of time, with the available staff and on the basis of available information. Methods of plan formulation will have to be adapted to these circumstances and also in many instances considerable deficiencies will have to be accepted from the substantive point of view, the remedying of which will have to be postponed until a subsequent round of plan preparation.

[43] From an unpublished report by Professor Jan Tinbergen on the organization of planning and the training of the planning staff in Egypt, prepared for the United Nations Technical Assistance Programme, October 1957.



The log chute at the site of the Petajoskoski hydroelectric project on the Kemi River in Finland

Formulation of projects

Individual projects play a role of primary importance in every development plan: the project proposals are, as stated earlier, an integral part of the primary material in plan formulation, and the final plan should be spelled out in the form of project programmes.

The evaluation of projects, and especially the comparative appraisal of project proposals which claim the use of the same limited resources, can only be responsibly carried out on the basis of full information on the projects in question as regards their organization, technical and financial aspects. Such information is equally needed to ensure a smooth execution of the projects once they have been approved.

A persistent weakness is being experienced, however, in almost all developing countries with respect to the systematic preparation of project data on a comparable basis. This is, for instance, expressed by the Planning Commission of India. "One of the main difficulties which has been observed is that frequently when the Government has to approve a project, say, for inclusion in a Five Year Plan, it has not been worked out fully, nor is it presented in any adequate form. A check list of items included in cost estimates of projects was circulated to the Central Ministries concerned in March 1960, but Ministries found it difficult to provide the minimum data required. The consequence is that for a large proportion of projects included in the Third Five Year Plan, the information available is still far from satisfactory. This deficiency arises in part from lack of requisite technical personnel, but equally it is due to the absence of arrangements, for preparation of projects well in advance of the time for their consideration and approval by the Government."[44]

[44] Economic Commission for Asia and the Far East, "Speed and Efficiency in Development Administration", paper submitted by India to the Conference of Asian Economic Planners (CAEP.1/Country Paper 8), pages 12 and 13.

The preparation of projects takes considerable time and should form a continuous activity of the planning cells in the ministries and in the regions. For example, the Planning Commission of India suggested, when presenting the third five-year plan, that "the Ministries concerned with industrial projects should take in hand forthwith project studies relating to the Fourth Five Year Plan, so as to complete these as far as possible in the course of the next three years".[45]

The preparation of projects will usually be carried out by the technical ministries. In many cases, advice and assistance of outside experts will be required. "It would be helpful for Ministries to arrange for technical advisers for different groups of industries, so that the technical knowledge and experience within the country . . . can be readily utilised by Government in developing public sectors."[46] It may often be necessary to engage foreign experts for this purpose.

The planning cells in the executive ministries should preferably assume the responsibility of ensuring that the information on the projects is adequate with regard to all relevant aspects. This should include reliable estimates of foreign exchange expenditure, total costs and the gestation period of the project. It will be equally necessary to have a clear outline of the administrative specifications, matters requiring multiple and collateral clearance, organization for co-ordinating work of different agencies and tentative arrangements for issuance of tenders and training of personnel to minimize the administrative time lag between approval and implementation. A check-list of the elements that should be covered in the project report is presented in table 1.

Table 1

ESSENTIAL ELEMENTS OF THE PROJECT REPORT

I. Administrative specifications:
  (*a*) Ministry, department and individual officer-in-charge
  (*b*) Transfer of officers to the project authority requiring clearance with the responsible ministry
  (*c*) Specifications of jobs for the recruitment of new personnel through the public service commission or other responsible agency
  (*d*) Co-ordination committee of representatives of different ministries (if necessary, list of members and officer-in-charge of co-ordination)

II. Blueprints of machinery and design of buildings, etc.

III. Location:
  (*a*) Acquisition of land
  (*b*) Legal and financial implications

IV. Incidents:
  (*a*) Transport, power and water supply
  (*b*) Development of raw materials
  (*c*) Housing, drainage, domestic water supply, etc.

V. Balance-sheet of inputs for construction:
  (*a*) Manpower, by categories of skills
  (*b*) Machinery and plant to be installed
  (*c*) Equipment and tools required for execution of the project
  (*d*) Material inputs

VI. Acquisition of inputs for construction:
  (*a*) Foreign exchange requirements; plant, equipment and technical services
  (*b*) Inputs to be purchased by the central purchasing agency
  (*c*) Inputs to be purchased by the programming agencies

VII. Construction schedule:
  (*a*) Agencies:
    Public works department
    Contracts to be assigned
    Programme agency
  (*b*) Phases, time schedules and co-ordination

VIII. Arrangements for protection of persons and property

IX. Detailed estimates of costs:
  (*a*) Schedule of costs for the programme agency—for land, construction equipment, machinery installation, materials, wages and salaries, etc., total and for each phase of construction
  (*b*) Schedule of costs according to the check-list of the central planning agency
  (*c*) Schedule of costs for each financial year until the construction is completed in accordance with the check-list of the ministry of finance
  Time-table agreed with the ministry of finance for the pre-budget scrutiny

X. Tentative arrangements for issuance of tenders and training of personnel

XI. Estimates for the operation of the completed project:
  (*a*) Administrative specifications
  (*b*) Balance-sheet of inputs
  (*c*) Recurrent foreign exchange expenditure (e.g., royalties, technical services, maintenance imports, imports of raw materials, etc.)
  (*d*) Cost and profits; capacity for self-financed growth

XII. Broad technical and financial evaluation of the project:
  (*a*) Net contribution to foreign exchange resources, national income and employment
  (*b*) Rate of return; self-financed expansion; growth potential
  (*c*) Acquisition of new technical knowledge and experience relevant to future growth of the economy
  (*d*) Technical progress: life span of the plant; prospects of obsolescence; growth of substitutes, etc.
  (*e*) Relevance to the strategy of the plan and priorities of the plan

CO-ORDINATION OF PLAN FORMULATION AT THE AGGREGATE, SECTOR AND PROJECT LEVELS

At the earlier stages of development planning, one of two main lines prevailed as regards the sequence in which the various levels were taken up in the planning procedure. In the first one, "planning from above", the sequence, in principle, is such that, first, the targets for such macro-economic magnitudes as total production, consumption, savings, investments, imports and exports are determined; subsequently, these totals are split up by sectors, and, finally, the corresponding proj-

[45] *Ibid.*, page 13.

[46] *Ibid.*, page 15.

ect programmes are prepared. Conversely, in "planning from below", the project proposals are the building stones which are first prepared; these are combined into programmes and on their basis the sectoral plans are prepared which are then finally integrated into the plan for the national economy as a whole.

The exclusive use of neither one of these two lines proved to be satisfactory. Planning from above, without sufficient pre-knowledge of the range of profitable possibilities at the micro-level, tended to result in plans in which the development of one sector was provided for in excess of its realistic possibilities at the expense of more profitable possibilities in other sectors for which there was no scope within the predetermined sector targets and resource allocations. And in planning from below, the main problem consisted in the fact that the tailoring down of the project programmes to bring them within the limits of aggregate resources tended, because of the lack of directives derived from macro-economic analysis, to be carried out in an arbitrary way and resulted in a mere conglomeration of projects.

It is for this reason that in modern development planning both lines are usually followed simultaneously – that is, main directions of development strategy and priorities derived from analysis at the macro-level are used in planning at the lower levels and, at the same time, information regarding programmes at the lower levels and individual projects is used in the planning at the aggregate level for comparative evaluation, internal consistency, macro-economic confrontation with aggregate resources and physical and financial integration into the national plan. The final plan then emerges from a process of repeated adjustments of the results obtained at the various levels, and the best plan is produced when the two lines are kept in proper balance.

The process is effectuated, as was indicated earlier, through intensive collaboration between the central planning agency, which is aware of the over-all strategy and priorities, and the planning cells in the executive ministries, which are the depositories of most of the technical knowledge and administrative experience. The ministries are in contact with living reality and are also familiar with the specific problems pertaining to their fields of activity. The assistance of their planning cells is indispensable for translating, under guidance of the central planning agency, sectoral plans into a programme of individual projects. This involves, among other things, the evaluation of project proposals; the allotment of priorities among project proposals competing for the same resources according to their contribution to the realization of the sectoral targets and the general objectives of the national development plan, and the proper timing of the execution of the approved projects. The ministerial planning cells will also be instrumental in the elaboration of policy measures for the realization of the plan as a whole. Again, the executive ministries are the agencies which can familiarize the central planning agency with the administrative and technical issues involved in the execution of projects and policy measures.

For the effective co-ordination of planning at the aggregate and sectoral levels, it is necessary to organize on an *ad hoc* basis joint working groups of representatives of the central planning agency from each relevant division and their counterparts in the ministries, departments and key public enterprises. The working groups should comprise selected administrators, technicians and economists. These groups should deal with individual branches of the economy as well as with co-ordination among the different branches, for example, industry, transport and power. Some of the groups, such as that on agriculture, may have to form a number of subgroups. The reports of the working groups constitute the basic material for the formulation of the plan. For the third five-year plan of India, twenty two such working groups were set up. The working groups serve an additional purpose: they give a sense of participation to the implementing agencies and familiarize them with the nature and magnitude of the tasks, thereby making the execution of the plan smoother and swifter.

Co-ordination of planning at the national and regional levels

The procedure for co-ordinating regional plans with the national plan in a federal system depends in part on the distribution of powers between the central government and the state governments. In very general terms, the central planning agency indicates the main priorities for development and the resources – grants and loans – which the central government is likely to allot to the regional authorities. The central grants and loans are often linked to specified types of activities and projects. The regional planning agency prepares a regional plan, taking into account the local resources, help from the centre and local needs and priorities, which is then submitted to the central planning agency for approval and incorporation into the national plan.

The second stage in the procedure may take either of two forms: a joint standing or *ad hoc* planning committee representing the central planning agency and the state authorities may be set up to integrate the regional plans into a national plan, or, alternatively, a series of meetings and conferences, at different levels, of the representatives of both the agencies may be held for the same purpose. It may be noted that the regional planning agency of a federated state plans only for those activities which fall within the state government's constitutional responsibility. The regional plan does not, therefore, include the projects and schemes which will be undertaken in the region by the central government.

Schemes for the use of local resources, including the labour force, are taken into account in the regional plan although their implications in terms of absorption of agricultural labour and over all rural development are consolidated at the district level and subsequently incorporated into the regional plans in a federal system. In a unitary state, they are consolidated by the relevant ministries and submitted to the central planning agency as part of the proposals by the executive ministries.

Co-ordination of planning at the national and regional levels may require special procedural arrangements in countries with a federal system of government. "Where-

as the relation between the planning unit and the executive departments . . . in a unitary state is institutionalized naturally at the Cabinet level, in a federal system an additional mechanism or institution is necessary and must be invented."[47] In India, the National Development Council is such an organization representing the central and state governments and examining matters of policy and major details, while detailed co-ordination is realized by the Planning Commission through regular meetings with the representatives of state governments. These functions are performed in Nigeria by the National Economic Council and the Joint Planning Committee.

Inter-departmental co-ordination in plan formulation

Successful planning requires close co-operation between the central planning agency and the ministry of finance since the scale of the public investment programme is determined by the ministry's ability to mobilize the resources, and its execution according to time schedule depends on timely appropriation of funds for the project expenditures. Such co-operation may be ensured by making the finance minister *ex officio* part time member of the central planning agency, the secretary of the ministry of finance the chairman of the *ad hoc* resource working group and the ministry's chief economic adviser *ex officio* adviser to the central planning agency. Inviting officers of the ministry of finance to the important meetings of the central planning agency at different levels, and vice versa, can significantly contribute towards the co-ordination and co-operation between the two agencies.

The close association of the central bank with the central planning agency is necessary and useful, although the former often operates under the guidance of the ministry of finance. As stated before, the research division of the central bank may undertak research work for the central planning agency in the fields of banking, the capital market and monetary policy. The chief economist of the central bank may be nominated as a member of the advisory committee of the economists, and the responsible executive of the central bank may work as a member of the *ad hoc* working group dealing with resources.

Liaison and co-ordination between the central planning agency and a number of agencies entrusted with the execution of important policy matters are also desirable. Such agencies include those dealing with protection of industries, licensing of capital goods, and permits to private enterprise to undertake investments and raise capital, as well as the committees dealing with foreign aid and agreements. In India, the Planning Commission has representatives on such agencies as a standing arrangement. However, *ad hoc* arrangements suitable to local conditions can also serve the same purpose.

Standing bodies, *ad hoc* bodies, members of one agency occupying *ex officio* positions in other agencies, regular conferences, invitations to the meetings of one agency extended to the corresponding representatives of other agencies and informal contacts represent different means of securing liaison and co-ordination between the central planning agency and the executive ministries. The means adopted in any specific circumstances will depend on the importance of the issues requiring co-ordination, whether they need continuing or periodic attention and the availability of time and personnel. Moreover, more than one means may be adopted at one and the same time.

Interplay between policy maker and planning technician

The previous sections of this article have dealt mainly with the procedural aspects involved in the preparation of the technical plan. As was mentioned earlier, however, the plan results from an interplay between the policy maker and the planning technician. The procedural arrangements in this respect should preferably be such that the functions of each of these are given due emphasis in the process of plan formulation, and that they are sufficiently dovetailed, while each retains sufficient independence to comply with his own responsibilities.

Some arrangements have been discussed earlier whereby policy maker and planning technician are combined in one and the same agency. In these arrangements, the integration of both functions will normally not cause a major difficulty: the problem rather will often be to prevent an undesirable amalgamation. In such a case, the planning technician may follow indiscriminately the indications of the policy maker without sufficiently examining their implications and weighing them against alternative possibilities; or, conversely, the policy maker may yield too easily to the apparent logic of the technician.

When policy making and planning technique are embodied in separate agencies, it is often the reverse problem that requires attention, that is, to ensure that both functions are sufficiently integrated and, more specifically, that the planning agency bases its work on a correct interpretation of the government policy. To this effect, the technical planning agency "should submit an ***outline*** clarifying to the Government what are the possibilities of the situation and what main alternatives are available. A further elaboration of the plan should then be based on an approval, in principle, by the Government and a choice made with regard to the alternatives presented".[48] In countries where a separate planning commission exists, this commission may appropriately assume the function reserved to the government in the foregoing quotation. The core of such an outline should be a table of resources showing their alternative uses and indicating in each case the contribution to be made to the national income and foreign exchange resources, the extent to which investable resources would be available for the subsequent plan, the impact on the distribution of income, expansion of employment, improvements in *per capita* and total consumption and the like. This process is sometimes repeated in a number of consecutive rounds; that is to say that, after the first consultation, the tech-

[47] *Administrative Organization for Economic Development: Conference Report*, page 46.

[48] Professor Jan Tinbergen, op. cit.

Sand dune fixation with plants in the Libyan desert near Tripoli

nical planning proceeds with the plan preparation in somewhat greater detail, taking into account the comments of the commission; after this, the consultation procedure is repeated. After three or four rounds of increasing detail, the plan is completed. Sometimes, parliament is invited to assign representatives of the main political groups to participate in this procedure at the policy making end; this may contribute towards the creation of an atmosphere of better understanding and joint responsibility between government and parliament and, consequently, to a more active support by parliament of the government's policy based on the plan.

PARTICIPATION OF THE PRIVATE SECTOR IN THE PLAN FORMULATION

THE PRIVATE SECTOR occupies an important place in the national economic plan of a country with a mixed economy. The experience of France, India and Japan has demonstrated that it is possible successfully to integrate the private sector in development planning. Reforms of some of the existing economic institutions and the establishment of new ones have already been indicated above; the principal emphasis in this section is placed upon the means by which the participation of that part of the private sector associated with modern enterprises may be secured in the formulation of the plan.

MAIN ISSUES

Priorities in the national economic plan are based on over-all economic considerations, that is the national economic profitability in the long run. The plan projects are worked out on the basis of these priorities and include projects to be executed in the public and private sectors. There are two grounds for allocating projects to the public sector, namely, the government policy of reserving certain fields of economic activity to state ownership and operation, and the inability or unwillingness of private enterprise to undertake some projects, either on account of the technological and managerial complexities, economic uncertainties or low rates of return, or because the size of the investment is beyond the means of the private sector under existing circumstances. The plan has to be flexible and consist of minimum and maximum programmes. The minimum programme would consist of essential projects to be executed in spite of all difficulties, while the maximum programme would include additional projects to be carried out if additional resources are available (especially foreign exchange and managerial talent) and if the response of the entrepreneurs is favourable. The minimum programme would include all interdependent projects and other strategically important projects.

The private sector is not obliged to conform to and carry out the projects outlined in the plan; it has to be persuaded to do so. This means that the government has to make the projects in the plan profitable and convince private enterprise that they are so. Since the private sector invests in projects on the basis of a descending order of profitability, the government will have to ensure that the profitability of the projects is relative to their planned priorities. It would be futile to expect the private sector to carry out the projects envisaged in the plan without also ensuring their relative profitability.

Private enterprise assesses the profitability of individual projects and does not think in terms of the broad targets for individual sectors. Moreover, entrepreneurs in underdeveloped countries may not be able to visualize such targets and translate them into terms of individual projects. It is therefore almost indispensable to work out the programme for the private sector in the form of specific projects. Secondly, the planning authorities should preferably spell out the technical and financial assistance that would be rendered for each project. Similarly, fiscal in-

centives and other inducements should be given and worked out in terms of specific projects. Finally, the government should anticipate the possibility that some of the projects included in the minimum programme for the private sector may not be undertaken by private enterprise. In such an eventuality, the government will have to step in and execute these projects and operate them until the private sector is willing and in a position to take them over. This possibility further underlines the necessity of translating the programme for the private sector into individual projects and brings out the desirability of working out in some detail reports for essential projects assigned to the private sector.

Machinery for consultation

The participation of the private sector in the formulation of the plan has several distinct advantages. First, the association of private enterprise with the drawing up of the plan provides entrepreneurs with a picture of the final pattern of production of consumer goods, intermediate goods and capital goods, which forms a reliable basis for planning their investments. This knowledge of the final demand structure at the end of the plan and of the interdependence of the projects is a basis for planning investment incomparably superior to the so-called demand projections occasionally undertaken by private enterprise and which are usually in the nature of crude guesses and often mere hunches. Secondly, the diffidence of private enterprise in under-developed countries in respect to the technical execution of projects can be overcome in the course of such consultation. Thirdly, entrepreneurs get precise information on the financial and technical assistance and the tax concessions offered by the government for the execution and operation of the projects. Fourthly, the government benefits from the experience of the private sector and the knowledge of concrete difficulties faced by private enterprise. Fifthly, consultation with entrepreneurs in drawing up the plan enables the government to assess the potential of private enterprise and helps in drawing up realistic programmes for them. Finally, the most valuable advantage of such consultation is that it marks the beginning of co-operation in the execution of the plan.

The machinery for consultation with the private sector comprises *ad hoc* conferences, *ad hoc* working groups, and various committees and councils in the nature of standing bodies. For example, the Planning Commission of India, in the course of the formulation of the third five-year plan, had detailed discussions with the representatives of the Federation of Indian Chambers of Commerce and Industry, the Associated Chambers of Commerce of India and the All-India Manufacturers' Organisation. The Planning Commission also held conferences in 1959 and 1960 (the third plan began in April 1961) with the representatives of twenty-three important private sector industries.[49] Invitations were extended to representatives of industrial associations and several important industrial enterprises. These representatives can and do send memoranda to the Planning Commission before the draft outline of the plan is published and after it is published, prior to the publication of the final plan.

Ad hoc working groups take an important part in the planning procedures in several countries, notably France and India. The central planning agency prepares a broad perspective plan on the basis of the fifteen or twenty year general goals approved by the government. With this long term perspective in view, the planning agency formulates broad five year (medium term) targets for each important sector of the economy. These are given as a purely provisional guide to a number of working groups, one for each sector. The working groups formulate the broad long-term targets, as well as detailed medium term targets for their respective sectors, taking various technical and economic factors into consideration. In addition, they work out the detailed policy measures and programmes necessary to implement these targets, using the various studies made in the executive ministries, economic and technical research organizations and industrial enterprises. The reports of these groups form the basic material for the comprehensive plan.

These working groups consist of economists, technicians, administrators and other experts. In France, chiefs of important corporations, representatives of employers and employees, and leading technicians in the private sector are represented, along with the experts of the central planning agency and the executive ministries. More than eighty such *ad hoc* working groups participated in the formulation of the French fourth four year plan, and the Planning Commission of India set up twenty-two for the formulation of its third five year plan. Some of the working groups had several sub-groups.

A steering committee on industry, transport and power was formed in India with a view to co-ordinate the plans for these sectors. However, private industry was not represented. No official explanation has been given for this absence, but the small size of the corporate sector of the economy and the lack, by and large, of a few giant industrial corporations dominating individual industries combined with the technical backwardness of entrepreneurs may provide part of the answer. These very factors, however, enable the government to secure the co-operation of the private sector by other means.

The standing bodies take the form of development councils and advisory councils made up of representatives of the government and the central planning agencies, prominent persons representing employers, employees and consumers, and independent experts. These councils and committees participate both in the formulation and implementation of the plan. The Government of India has set up development councils for nineteen important industries and advisory panels for six others. In addition, the Government of India and the Planning Commission have the benefit of the advice of the Central Advisory Council of Industries on broad policy matters affecting the industrial sector. This Council also advises the Government on strategic industries through its

[49] *See* Economic Commission for Asia and the Far East, "Planning Machinery in India", paper submitted by India to the Conference of Asian Economic Planners (CAEP.1 Country Paper 9), page 25.

Students in the Chemical Engineering Department of the Indian Institute of Technology in Bombay

standing committees. Important among other advisory bodies in India are the Textile Commissioner's Advisory Committee, the Small-scale Industries Board, the Import Advisory Council and the National Productivity Council and its forty-three regional councils.[50]

Official agencies for formulating programmes for the private sector

It was noted earlier that it is necessary in the less developed countries to work out the plan for the private sector in some detail. This necessitates entrusting the task of formulating and executing private sector programmes to a technical agency in the government machinery. In India, this function is performed by a technical body known as the Development Wing, which is attached to the Ministry of Commerce and Industry. The Development Wing is represented on all the advisory bodies referred to above and it also participates in the *ad hoc* working groups of representatives of the Planning Commission and the central ministries, to which it brings the viewpoint of private entrepreneurs in formulating the programmes for the private sector.[51]

Official agencies are also required to regulate investment, capital issues and imports in the private sector. They usually take the form of interdepartmental committees. These committees should be serviced by the technical organization entrusted with the responsibility of formulating and executing the plan for the private sector.

Licensing of investment confines the scope of private investment to projects included in the plan. In examining the applications, the technical organization for the private sector takes into account plan priorities, technical feasibility, existing and anticipated demand, availability of suitable raw materials, choice of manufacturing processes, appropriate location and the like, so as to ensure maximum efficiency, economy of operations and the most advantageous utilization of the country's natural resources. Schemes involving foreign collaboration may be scrutinized by the same agency from the viewpoint of earning or saving foreign exchange and of financing the foreign exchange component of investment by the contribution of foreign capital or by securing imports of plant and machinery on deferred payments. This agency may set the conditions for the granting of individual licences; it may also be responsible for watching the progress of the implementation of schemes until the schemes are completed and units go into regular production. For this purpose, half-yearly returns should be submitted showing the progress made by the undertakings. The agency should scrutinize these returns to ensure that they conform to the conditions laid down in

[50] For detailed information, see Government of India, *Report of the Ministry of Commerce and Industry, 1961-1962* (New Delhi), 1962), appendix IV, pages 178 to 248.

[51] For details of functions, see Government of India, Ministry of Commerce and Industry, *Annual Report of the Development Wing (1957-1958)* (New Delhi, 1958), pages 1 to 3.

Scene at a health centre near Kabul, Afghanistan

the licences, including the time schedules for the different stages of implementation and report the progress made to the planning commission and other relevant agencies. A reasonable extension of time and technical assistance and guidance should be given in cases where genuine difficulty is experienced by the entrepreneur. In other cases, where unsatisfactory progress or no progress is made, the agency after giving reasonable opportunity to the entrepreneurs, may recommend to the investment licensing committee that licenses for these schemes should be revoked and granted to other entrepreneurs. These arrangements ensure that projects are approved and that they will be completed in a reasonable length of time.

The control of capital issues means that a corporation requires the consent of the government to issue securities, including mortgage deeds and other instruments of loan other than short term bank credit. The chief purpose of controlling capital issues is to direct resources into channels which, in accordance with the objectives of the plan, promote the sound capital structure of corporations and avoid undue congestion of offers for public subscription from private enterprises and the public sector during any part of the year. Control on capital issues supplements investment licensing and helps to ensure the systematic mobilization of resources.

Import licensing becomes an indispensable instrument for the rational utilization of available foreign exchange resources, which represent the critical bottle neck in most under developed countries. The objective of import licensing is not only to ensure adequate resources for important projects in the plan, but also to see that projects which require heavy recurrent maintenance imports are not established, save in exceptional cases. It also helps to encourage the formation of joint enterprises in which the foreign exchange component of the investment is financed through the contribution of foreign capital. The processing of import license applications should be entrusted to the same technical organization that scrutinizes applications for investment licenses.

In countries where basic industrial raw materials are in short supply, their allocation through a central agency or agencies will be needed to ensure that key projects in the plan receive adequate quotas. The same technical organization may be entrusted with the task of processing applications for scarce raw materials in respect of enterprises and projects and of servicing the respective licensing committees which take the final decisions.

The centralization in a single technical organization of the servicing functions for advisory committees and development councils and important licensing committees for the private sector is imperative for ensuring the realistic formulation and successful implementation of the programmes for the private sector industries.[12]

[12] The Development Wing in India offers an example of such a mechanism of such servicing functions.

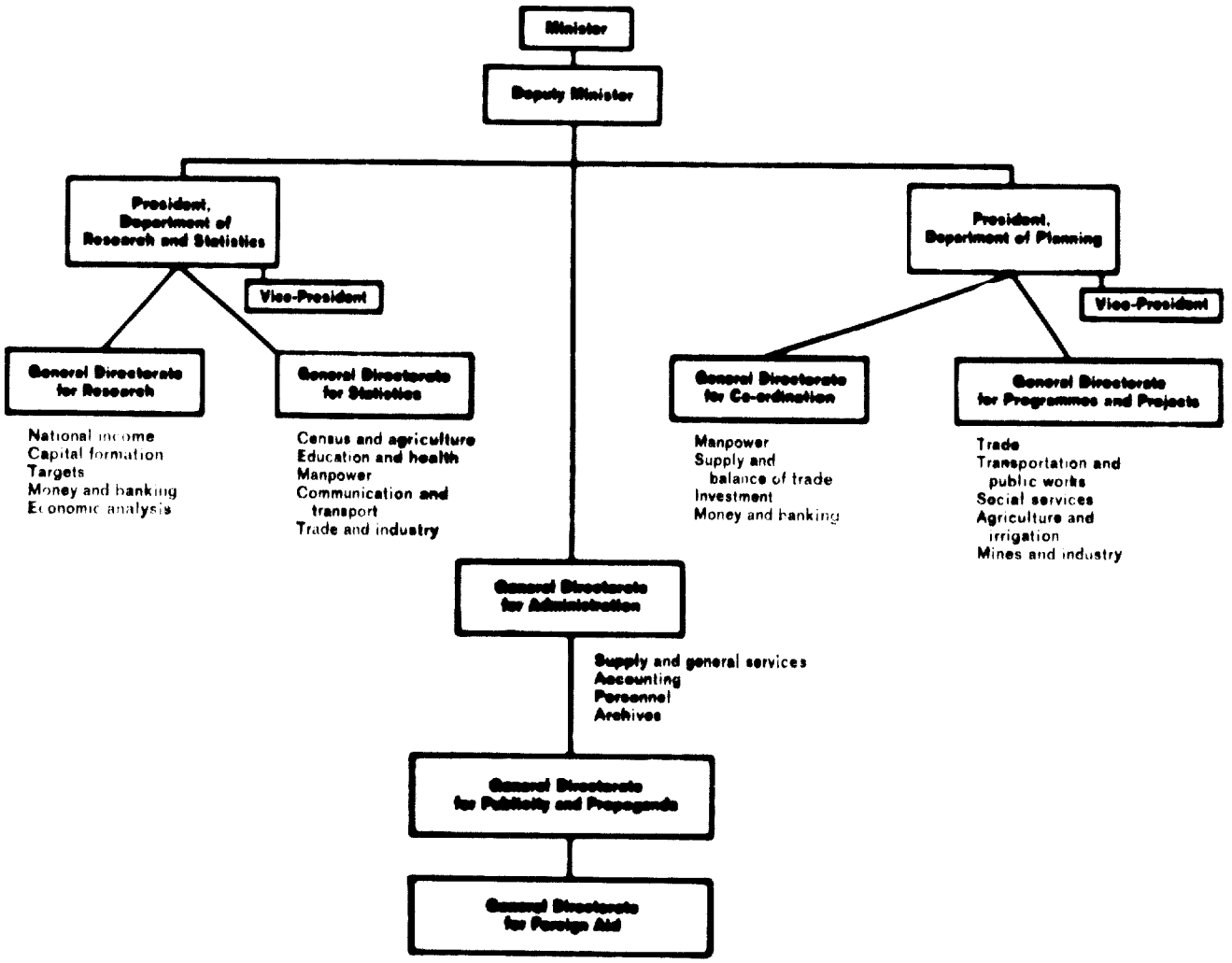
Trainees attending a class at the Technical Centre of Gagnoa, Ivory Coast

Annex I

PLANNING MACHINERY IN SELECTED COUNTRIES

Chart 1

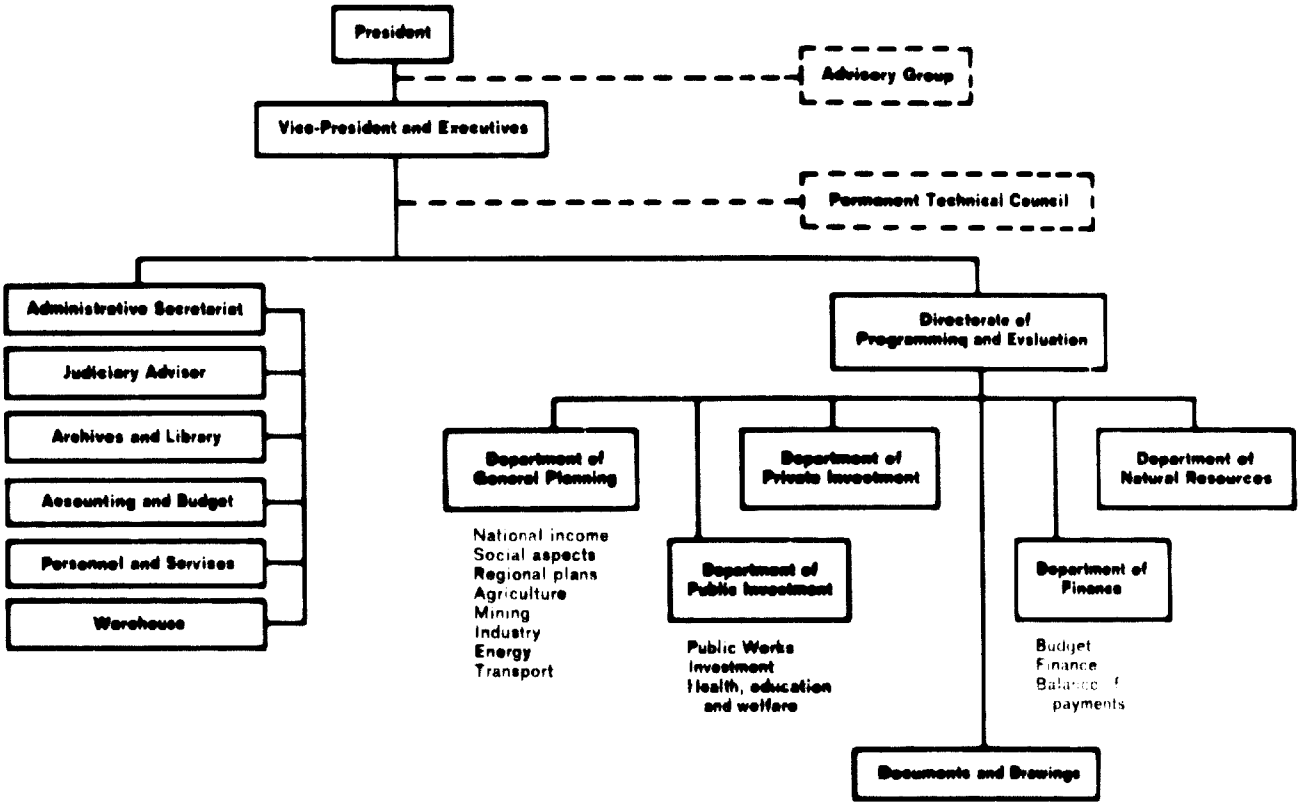
AFGHANISTAN: MINISTRY OF PLANNING



Source: Economic Commission for Asia and the Far East, "Administrative Machinery for Planning in the ECAFE Region", secretariat working paper presented to the Conference of Asian Economic Planners held in New Delhi, India, from 26 September to 3 October 1961 (E/CN.11/CAEP.1/L.3).

Chart 2

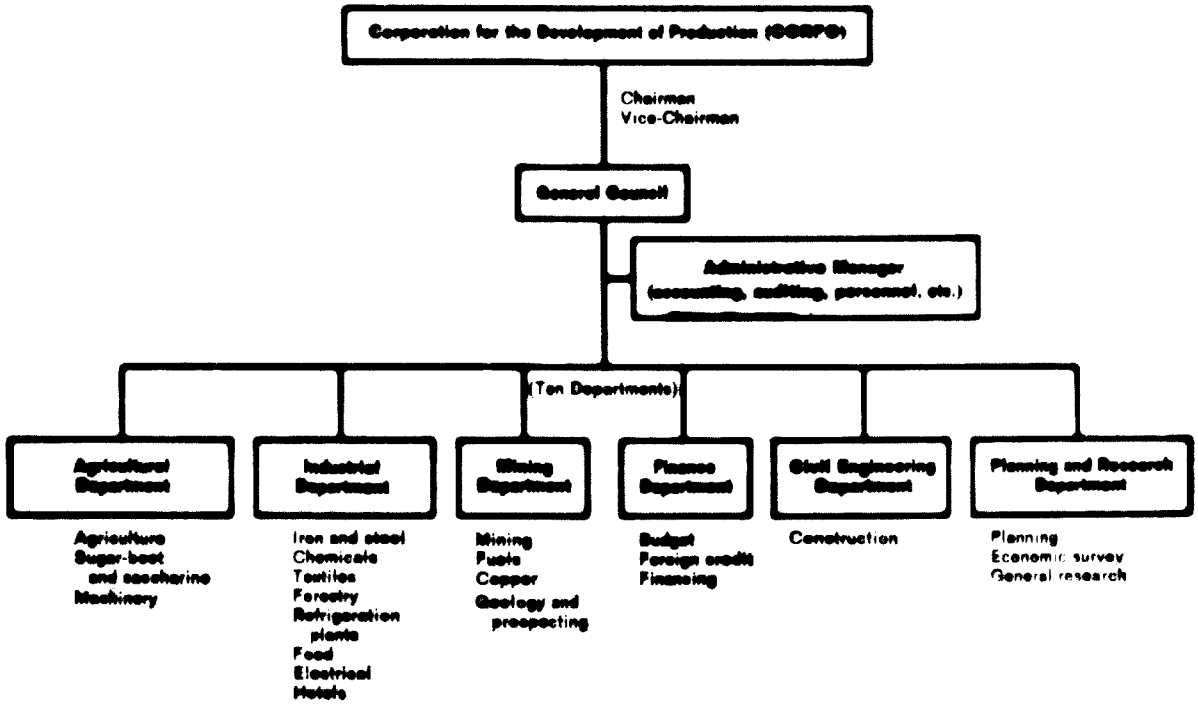
BOLIVIA: NATIONAL PLANNING COMMITTEE



Source: Bolivia Advisory Group, "Progress Report", No. 8, December 1961.

Chart 3

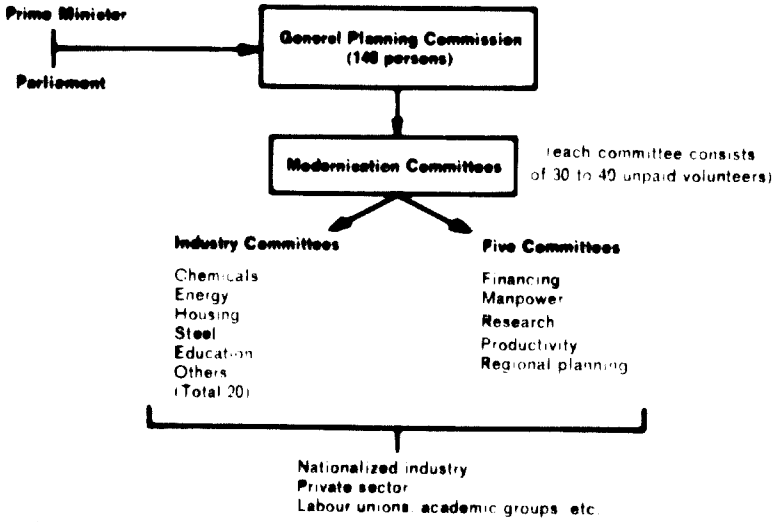
CHILE: CORPORATION FOR THE DEVELOPMENT OF PRODUCTION



Source: E. Tejera Paris, "Introduction to Public Administration in Development Policy", United Nations Technical Assistance report in the field of public administration (TAA/LAT/17, 12 December 1957).

Chart 4

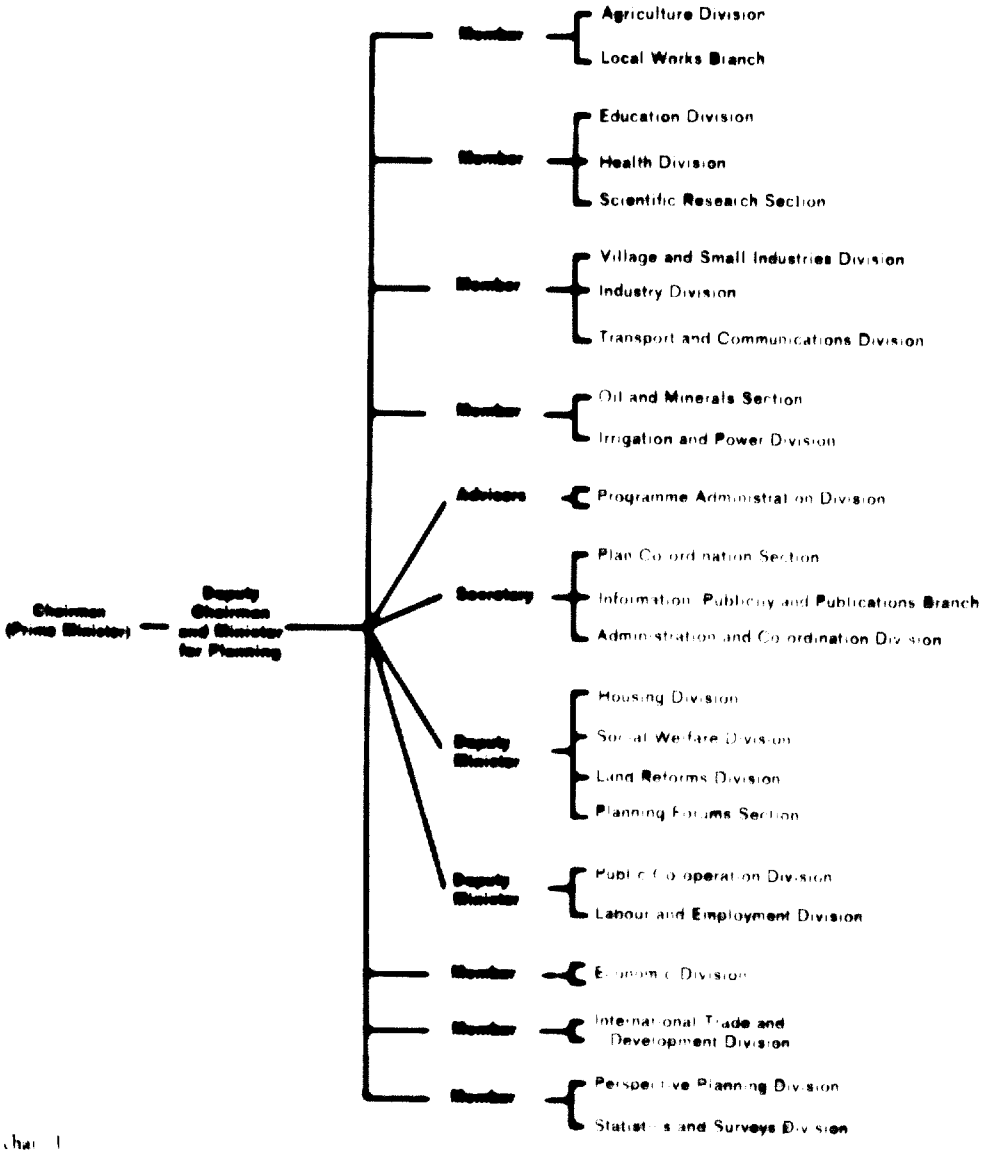
FRANCE: GENERAL PLANNING COMMISSION



Source: P. Massé, "French Methods of Planning", paper prepared for the Conference of Asian Economic Planners (CAEP.1/Country Paper 25); also *The Economist* (London), 26 August 1961.

Chart 5

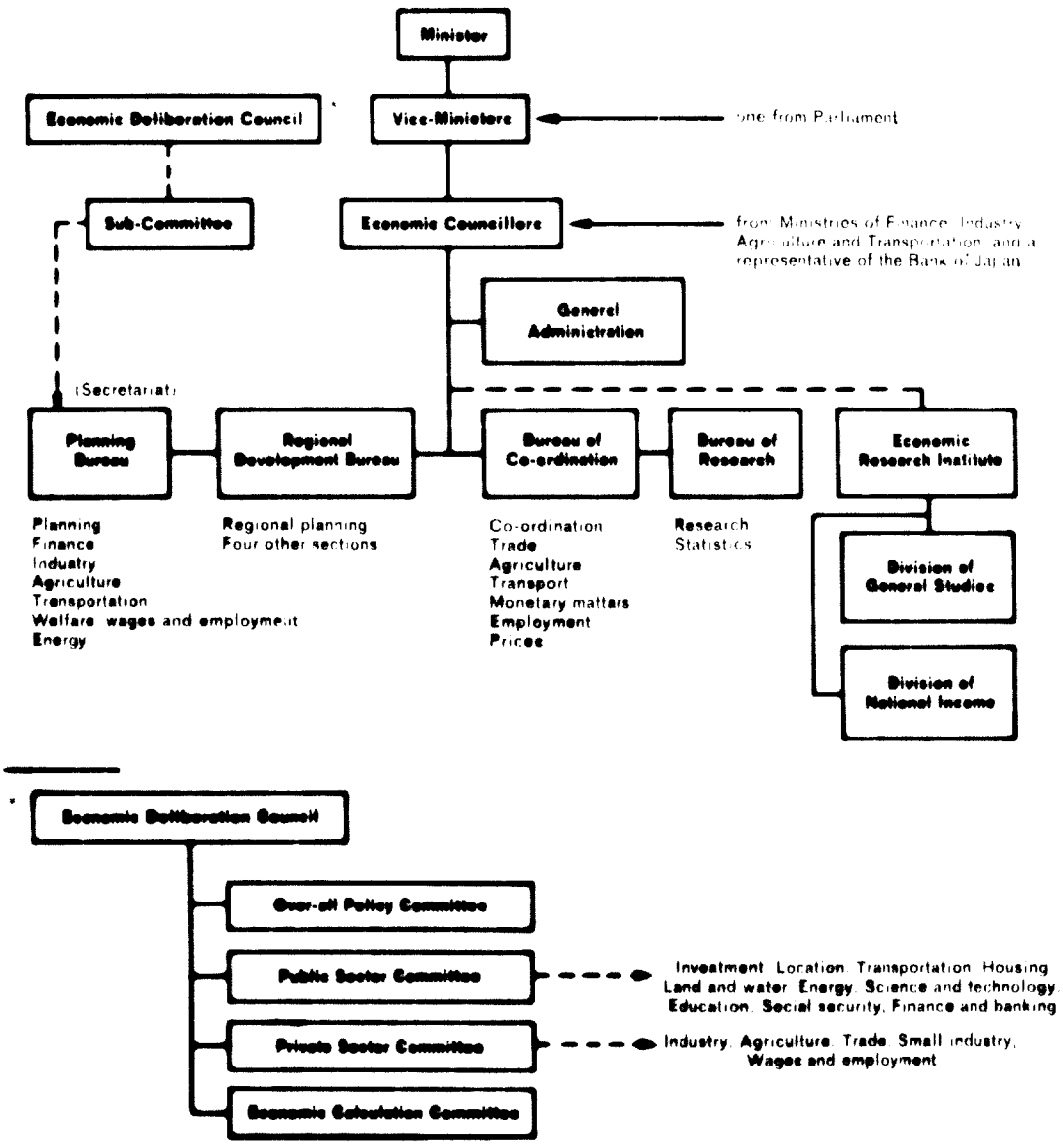
INDIA: PLANNING COMMISSION



Source: As for chart 1.

Chart 6

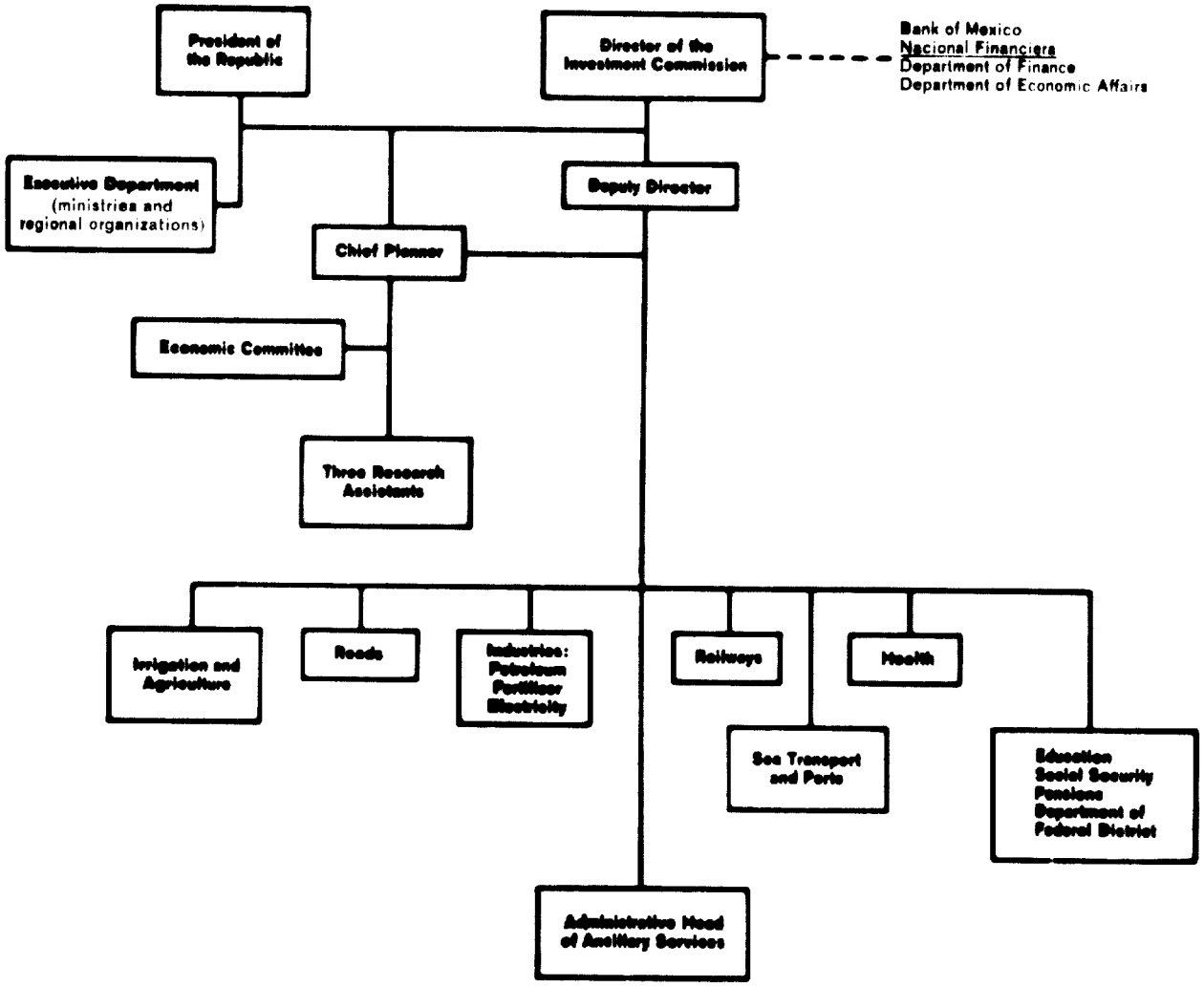
JAPAN: ECONOMIC PLANNING AGENCY



Source: Government of Japan, Economic Planning Agency, "Organizational Chart of the Planning Agency" (in Japanese, mimeographed), Tokyo, September 1960.

Chart 7

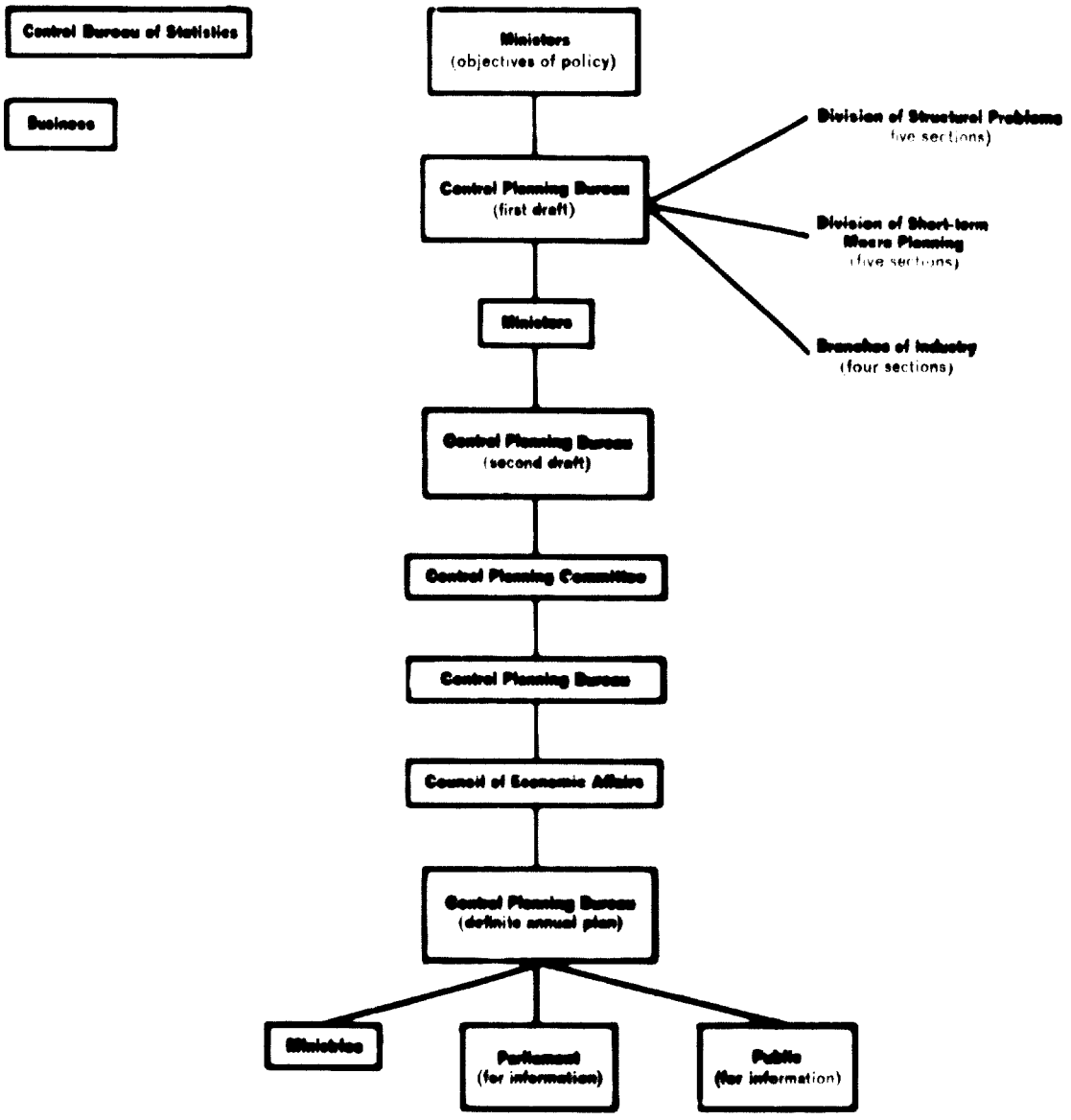
Mexico: Planning Agency



Source: As for chart 3.

Chart 8

NETHERLANDS: CENTRAL ECONOMIC PLAN

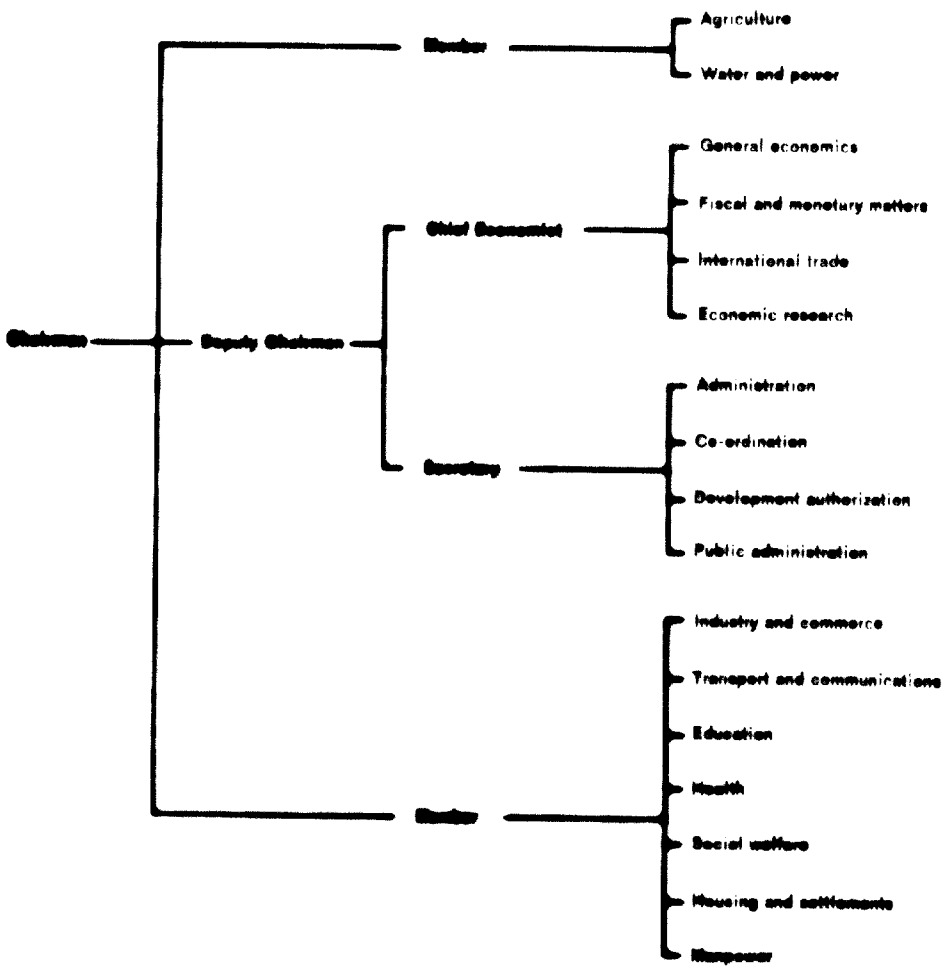


NOTE: This chart shows the planning procedures followed in the Netherlands rather than the organizational structure of the Central Planning Bureau.

Source: Government of the Netherlands, Central Planning Bureau, *Scope and Methods of the Central Planning Bureau* (The Hague, 1956), page 36.

Chart 9

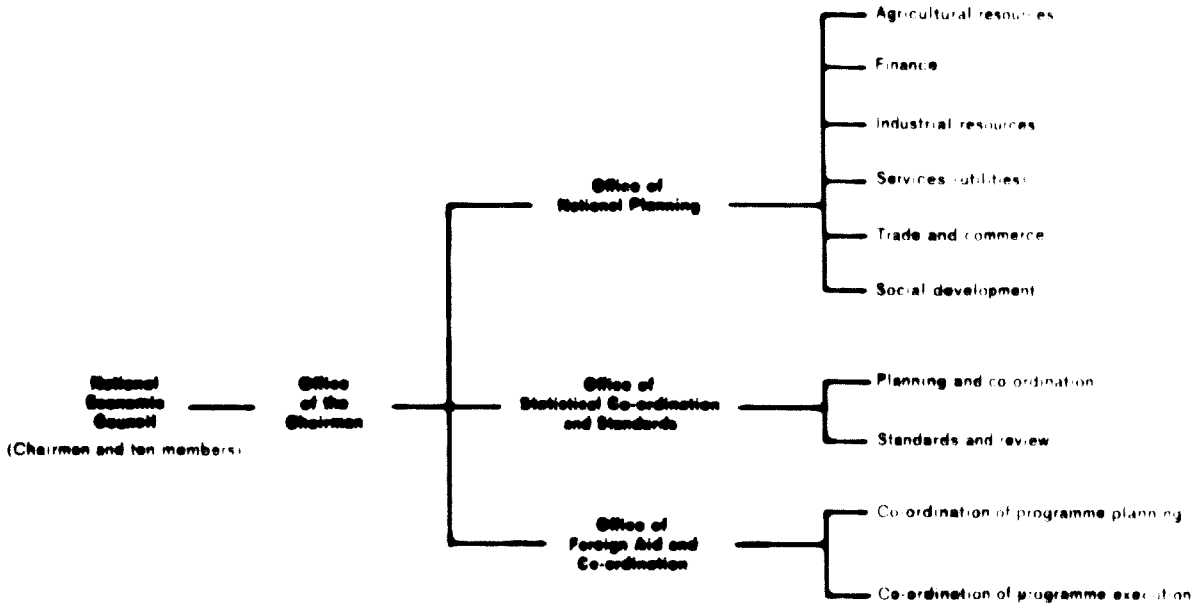
PAKISTAN: PLANNING COMMISSION



Source: As for chart 1

Chart 10

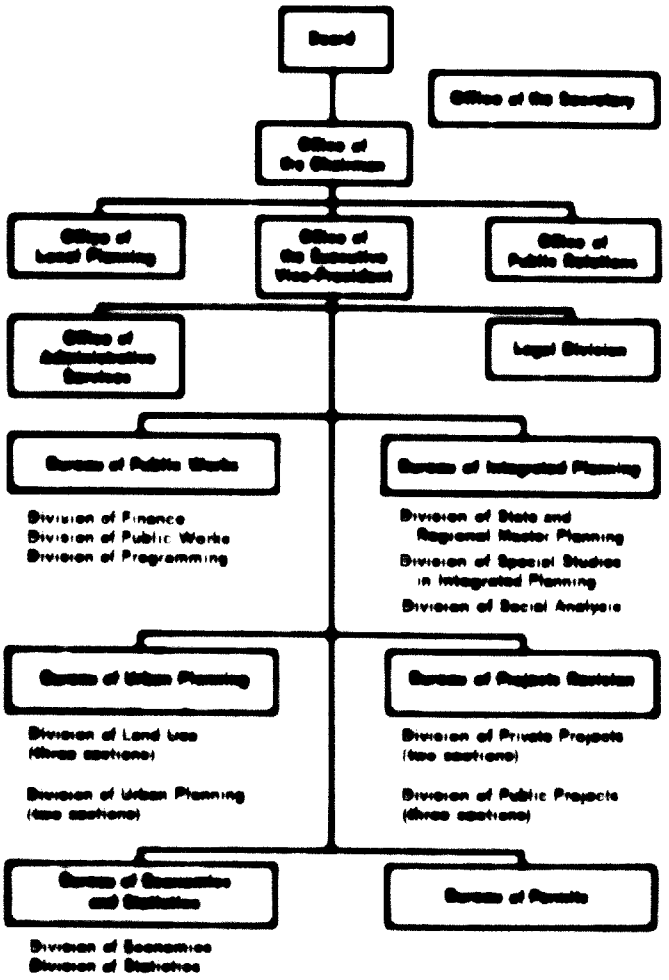
PHILIPPINES: NATIONAL ECONOMIC COUNCIL



Source: As for chart 1.

Chart 11

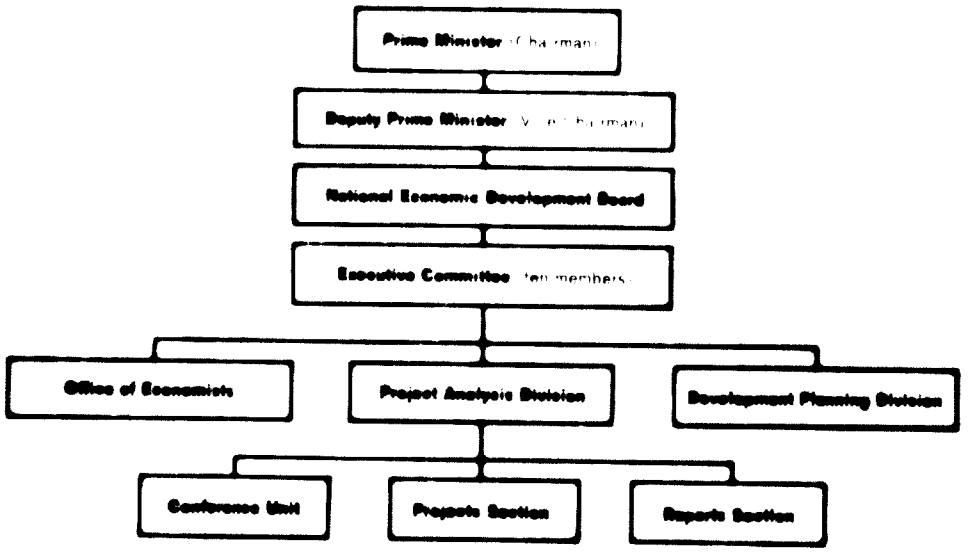
PUERTO RICO: PLANNING BOARD



Source: United Nations, "Planning for Balanced Social and Economic Development in Puerto Rico" *Planning for Balanced Social and Economic Development: Six Country Case Studies* (Sales No.: 64.IV.8).

Chart 12

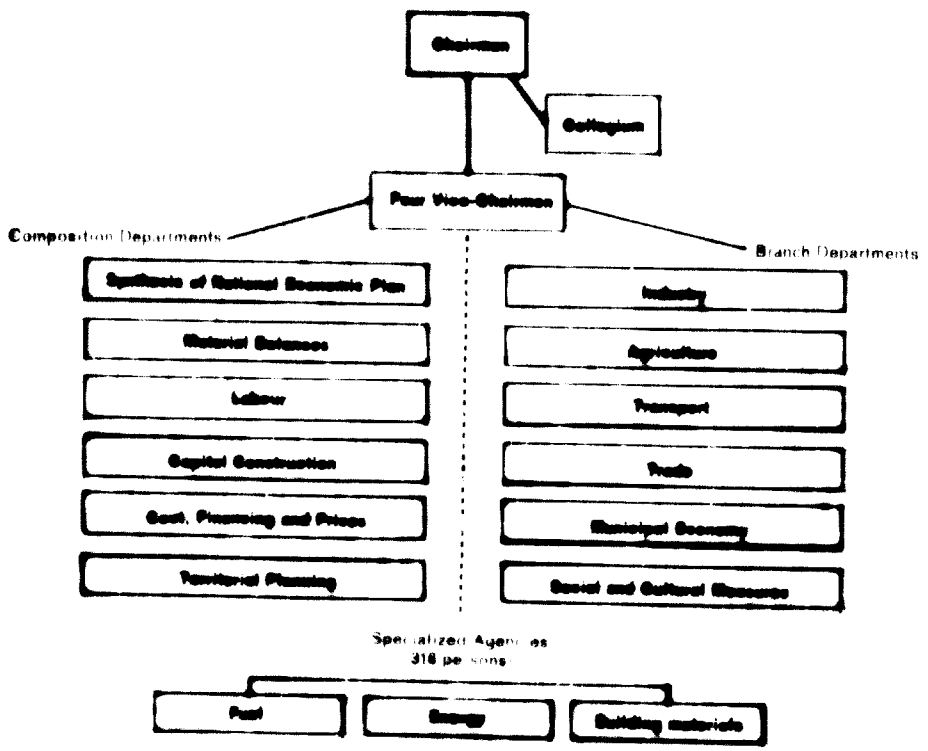
THAILAND: NATIONAL ECONOMIC DEVELOPMENT BOARD



Source: As for chart 1.

Chart 13

UZBEK SOVIET SOCIALIST REPUBLIC: STATE PLANNING COMMISSION[a]



Source: United Nations, "Planning for Balanced Social and Economic Development in the Uzbek Soviet Socialist Republic", (E/CN.5/[illegible]/Add.5/Rev.1).

[a] Staffed by 380 persons, including forty in the general service category.

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05184

Investment in Infra-structure versus Direct Production Facilities

By JAN PAJESTKA

In the field of industrial development programming certain problems arise which cannot be solved by applying mere programming techniques and methods. These are especially problems connected with general development strategy for which programming techniques are not a sufficiently useful instrument and those related to the institutional environment. The institutional set up in the economy is not always admitted to be a subject of choice in development policy. However since institutional conditions influence the choice of development strategy, it is precarious to assume that the implications involved here can be neglected.

The relation between investment in infra-structure and investment in directly productive facilities seems to be rather typical for problems of the character indicated. Therefore, it should necessarily be discussed within a wider context. However, the discussion of these problems presents some difficulties in view of the wide range of institutional conditions ranging from the centrally planned economies to developing countries relying principally on the free enterprise system.

Economic characteristics of the investment in infra-structure

One must start by defining the economic characteristics which constitute a basis for the theoretical and practical usefulness of the concept of investment in infra-structure.

The distinction between infra-structure and directly productive facilities is a relatively recent one. Infra-structure facilities are usually defined as comprising those basic services without which establishments producing commodities and services whether primary, secondary or tertiary industries cannot function. Broadly infra-structure includes public services, education, health, and the like, that is, social infra-structure, and transportation, communication, power, water and so on, that is, economic infra-structure. In a narrower sense, the principal sectors included in infra-structure are transportation and power.

The following features of the infra-structure are important in determining its economic characteristics:

(i) Infra-structure serves a great variety of economic activities and a great number of economic units.

(ii) Infra-structure performs auxiliary functions for the directly productive activities which are indispensable because they are unsubstitutable. In particular, import substitution is not directly achieved by investment in infra-structure.

(iii) Since infra-structure and directly productive establishments are complementary in the development sequence, investments in infra-structure must precede or at least coincide with the development of the latter.

(iv) Investments in infra-structure are typically characterised by indivisibility (in a technical sense) and by high capital coefficients.

(v) Because of the long run nature, many-sided effects (spare products, for instance) and other characteristics of investments in infra-structure it is often inappropriate to use the usual criteria of returns, both in operating and in programming.

Because of these features, particularly (iv) and (v), in practically all countries infra-structure is dominated by public agencies, even when run by private enterprises, it is the object of some form of public control. It is also because of the features just indicated that infra-structure occupies a special role in foreign capital aid for economic development.

It should not be overlooked, however, that these features of the infra-structure are very heterogeneous. Too much so to allow for the formulation of a simple theory of investment in infra-structure versus investment in directly productive facilities. In fact, some of the features mentioned are also common to certain groups of directly productive establishments.

Long periods of investment and a high capital-output ratio appear in certain other industrial sectors. The argument has been advanced that the steel industry for example has similar far-reaching and many-sided effects; therefore the application of 'normal' criteria of returns

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may also be deficient here. The phenomenon of complementarity is certainly not exclusive for infra-structure. More important, however, is the fact that the development sequence required by complementarity may apply with equal stringency to other industrial sectors under economic conditions in which balance of payments difficulties make it difficult to effect substitution by way of imports.

The above considerations may lead to some doubts even about the usefulness of the concept of infra-structure. As a matter of fact, in the centrally planned economies this concept has almost vanished from the economic vocabulary. It is being used somewhat rarely in certain countries in connexion with the development of backward areas.

Still, since establishments classified under infra-structure seem to have some interesting features for programming, particularly those indicated above under (i) to (iv), an economic analysis can bring to light certain points relevant for general economic programming. Mainly because of its direct relation to the institutional set-up, infra-structure merits special attention.

Institutional biases

It is self-evident that without the development of appropriate transportation and power facilities, industry cannot grow satisfactorily. Particularly for countries at lower development stages, the acceleration of industrial growth may require heavy investment in infra-structure to some extent prior to investing in direct productive capacities.

Quite often, however, in the developing countries there is a manifest tendency to over-invest in infra-structure resulting apparently from certain dogmatic views and biases brought about by institutional conditions.

One reason for over-emphasizing the importance of investment in infra-structure is reliance on the principle that investment in productive facilities is entirely the province of private capital and investment in infra-structure is the responsibility of the public sector.

It may be assumed that the real economic conditions of a country presuppose the existence of a rational division of capital investment between these two. It would seem rather exceptional for this relationship to have any connexion with the financial investment capabilities of the public sector on the one hand and the private sector on the other. Whenever a government's financial capacities are relatively large, there is a tendency to over-invest in infra-structure, as exemplified by oil producing countries.

Similar tendencies may result from the policy or practice in regard to the scope of a country's development programme. In cases where development programming is confined to public activities only, the danger of over-investing in infra-structure is particularly grave. This is also true when a development programme is based on an unduly optimistic appraisal of private capital investment domestic or foreign. Often the development of infra-structure facilities is considered a means to attract foreign capital, an expectation which may not necessarily be fulfilled.

As is well known, it is extremely difficult to make a precise quantitative evaluation of the infra-structure projects. In consequence, economic choice in that field has to rely principally on a direct appraisal of the needs and development prospects of a country or region. The lack of clear-cut quantitative criteria may lead to extension of the list of infra-structure projects, those on transportation being almost always useful to some degree, are particularly apt to be chosen. Unless this tendency for over-investment in infra-structure productive facilities is strongly opposed, and opposition can best come from the competing productive facilities projects, it is likely to go on unabated.

Infra-structure investment projects are often evaluated without recourse to *ex ante* and *ex post* criteria. Therefore, they are the "safest" projects to undertake. No economic or social sanctions are levied on the individual decision makers as a result of wasteful investment in infra-structure. Moreover, these projects have important publicity value and are often of more direct benefit to higher social groups.

On the whole, the influences tending towards over-investment in infra-structure are strong and efficacious in many countries. These tendencies need to be opposed, not in a negative way, but as a conscious strategy in development programming and policies.

Balanced development between infra-structure and directly productive facilities

There seem to be no reasons for establishing any relationship between investment in infra-structure and investment in directly productive facilities by means of a "general proportions" method.

Let us accept that infra-structure comprises two main sectors, transportation and power. Each of these performs such different economic functions that, in programming, merging them into one group adds nothing to what can be discovered about them separately. The best way to bend the general volume of infra-structure investment in programming is to determine the volume separately for transportation and power, and then add the results obtained.

Reasons for amalgamating these two separate sectors seem to stem mainly from situations in which institutional factors or priorities already laid down cause certain biases. Such situations occur in most of the developing countries.

The statements just made do not of course imply that, given certain features common to transportation and power, similar approaches in programming techniques cannot be devised for both of them.

It seems justified to state that, for determining investment in infra-structure in primitive programming techniques, neither the method of aggregative analysis nor that of historical or geographical comparisons is suitable. This is particularly the case for transportation investment.

The inappropriateness of historical comparisons of investment in transportation, for example, analyses of its share in total investment, for development programming

purposes seems most doubtful. Changes in transportation technology which have a serious impact on the capital investment required in that field have occurred over time.

It is fairly obvious that the developing countries of today are not going to repeat the pattern of railway development on a scale commensurate with that undertaken in the old industrial countries. Duplicating railway and road networks would be very wasteful for many transportation lines. Where reasons existed for building a railway line a few decades ago, the same conditions do not always obtain today. In most cases roads are more economical. In particular, they are cheaper to build because of lower capital expenses, and this necessarily has an impact on total capital investment in transportation.

The method of comparative analogy has special drawbacks because of differing geographical conditions. No one needs to be convinced of the degree to which the capital investment costs of transportation facilities depend on geography. One should not, therefore, expect much from the comparative method, even if similar proportions seem to appear for certain countries at various but similar stages of development.

It is simply a corollary of the above to state that determining the volume of investment in transportation with the help of growth elasticity coefficients and capital-output ratios estimated on the basis of data from a group of countries seems less reliable for transportation than for any other sector. This is true even when this method is used for the first rough approximation of the total volume.

Consequently, it would appear that the only appropriate method for solving the problem of estimating the total volume of investment in transportation is to use an analytical approach. In other words, while there is no reliable method for appraising the general volume of investment in transportation in the aggregate there are feasible methods for appraising a concrete programme of investment projects in transportation. These are the only reliable methods.

The power sector is somewhat different in the context of this discussion. Utilization of growth elasticity coefficients and of capital-output ratios seems more promising for this sector where the first rough estimates are concerned.

If investment in transportation is included in infrastructure, however, one should not fail to observe that the various transportation projects are not homogeneous with regard to the problems discussed.

Two kinds of investment in transportation may be usefully distinguished: (1) investment in basic transportation facilities: railways, roads, inland waterways, seaports and airports, and (2) investment in subsidiary equipment and in modernization, for example electrification and the like.

The first group has features typical of infrastructure: long run effects, high degree of indivisibility and complementarity. The second group bears more resemblance to investment in other industrial sectors.

It may be observed that during the historical development of those countries which are at present industrialized investment projects in transportation were changing character. In the early development stages investment in transportation covered mainly basic facilities which are complementary to directly productive projects and in a technical sense are inevitably their prerequisites. In the later stages, however, investment in transportation has more and more resembled other industrial investment.

In the highly developed countries and regions at present additional investment in the transportation sector bears little resemblance to investment in infrastructure. In such cases, the infrastructure problem loses its importance. Still transportation retains something in common in both developed and underdeveloped countries or regions since it is a field of public activity and control. The same may be true of the electric power sector. The "infrastructure problem" therefore becomes a problem connected with the role of the public sector and of the interplay between the public and the private sector.

Establishing basic infrastructure facilities permits the development of industrial activities. Amelioration of those facilities, as well as low prices for their services, may create more favourable conditions for industrial growth in certain geographical regions. More favourable conditions provide incentives. These incentives are being created at the expense of public funds. It may be appropriate to mention public subsidies in this context.

When infrastructure facilities are utilized for subsidizing private industries, they are homogeneous in this respect. In this sense both transportation and power are homogeneous: if controlled by public agencies, they can be utilized for subsidization and in this way they can promote private industries.

In connection with what has just been stated, the following question should be formulated: is infrastructure the most convenient and economical way of subsidizing and promoting private industries?

Subsidizing by infrastructure has certain special features called for by its economic characteristics. It is universal, indirect, and therefore not spectacular. On the other hand, it is very capital intensive, which is not a favourable feature in economic conditions prevailing in the developing countries.

Certain misunderstandings are likely to arise if the economic features of infrastructure are confused with its role as a subsidy instrument for private industrial activities. It would seem useful to distinguish between these two aspects.

It is precisely in connexion with the role of the public sector, which is expected to promote general economic development and which can do that, for example, by investing in infrastructure, that a problem arises defined as "development and excess capacities in infrastructure".

It may be observed that the sectors classified under infrastructure are not the only ones which can perform the function of promotion by subsidizing development in general. There seems to be no reason for confining such a subsidy policy to infrastructure when coal and other fuels, building materials, steel, and the like would be equally suitable as instruments.

When the basic infrastructure facilities are considered with reference to their economic characteristics proper as complementary establishments which are absolutely necessary for productive industrial development, the problem of "development and excess capacities in infrastructure" disappears. Basic infrastructure facilities constitute an indispensable condition for the development of modern industry, and this is most important.

In the centrally planned economies, where infrastructure facilities are not considered in the context of the public versus the private sector, the problem of "development and excess capacities in infrastructure" is never viewed as a desirable strategic line of economic development. Rather an opposite strategy is followed: that of obtaining the maximum savings in infrastructure investment. Achieving these maximum savings does not imply, however, a shortage in infrastructure facilities. It means "balanced development" between infrastructure and directly productive facilities.

It should be added, to avoid misunderstandings, that excess capacities in infrastructure facilities caused by the phenomenon of indivisibility may be justifiable.

The balanced development between infrastructure and directly productive facilities means that (1) the projected growth of output can be achieved without encountering hostle necks in infrastructure facilities, and (2) there should be no excess capacities in infrastructure above what is due to the indivisibility of the facility.

Theoretically a programme of infrastructure projects should be a result of general development programming. In it should be evaluated various alternative solutions comprising sets of infrastructure and productive facilities complexes. By this means an optimum infrastructure programme could be found: thus would also be balanced development.

In practice, we are still far from the application of comprehensive models which would permit finding an optimum solution among the various alternative solutions. Assuming the use of more "pedestrian" methods, one should proceed along the following general lines.

1. Rational programming of infrastructure facilities can be done only within the framework of a general development programme, which should include both public and private activities; the general programme must be of long run character. A minimum of information about developments in neighbouring countries is necessary.

2. Investment in the different sectors of infrastructure must be based on relatively detailed studies concerning the development areas and the prospective markets. Each major project should be analysed in close connexion with the related directly productive projects. The subject of economic analysis should be the complexes comprising related infrastructure and productive facilities projects.

3. The economic features of infrastructure investments indicate that concentration of investments into direct production facilities brings about a higher utilization of the investments in infrastructure and therefore higher social returns from the latter. This fact should be observed unless other processes prevail.

4. Direct savings in infrastructure investment are highly recommended. The experience of many countries shows that there is great scope for effecting such savings.

5. For final checking of the infrastructure investment programme, it would seem useful to apply the two criteria of balanced development mentioned above.

Analysis and Projections of Consumption Demand: Methodological Notes

INTRODUCTION

The present study deals with various methodological problems concerning the derivation and extrapolation of parameters constants for consumption demand projections. Discussions are extended to some problems and techniques relating to the analysis of cross-country patterns or international reference patterns.

This study was conducted under the work programme of the Centre for Industrial Development of the United Nations Department of Economic and Social Affairs relating in particular to the methodology of programming and is an excerpt from a larger study submitted to the Committee for Industrial Development at its fourth session in March 1964.

Since there is no absolute standard for predicting the future, the crucial problem in projections lies in the building of a framework in which relevant data and reasonable assumptions are interwoven in an objective and consistent manner. A variety of methods are thus used in practice, with varying degrees of complexity and precision, but they all have one common element in their logical structure that is, the uses of invariances or parameters constants through which unknowns are related to given predetermined variables. The main purpose of this study is to examine the characteristics of such invariances and to appraise various procedures of estimating them with particular reference to consumption demand.

There has been a great deal of accumulation of research studies in the area of household consumption.[1] The main task of the present study is not to compile a bibliographical survey of these studies but to clarify certain important methodological issues facing them.

First, the problem of choice among alternative forms of demand equations is discussed in connexion with the estimation of Engel curves, in which income or total consumption expenditure is the only explanatory variable. The same problem is not independent of the nature of the basic data on which the statistical analysis is based. The discussion is thus extended to the comparative merits of alternative research techniques related to alternative types of data. The differential implications of the estimation results derived from different types of data emerge as a warning against excessive naivete in applying estimation results in the context of projections. Proper attention should be paid to various possible sources of estimation biases and specification errors. The same section deals with a few other important technical matters such as treatment of stratified samples, substitution among related goods, special devices for estimating direct and cross price elasticities, use of autonomous trend as a catch-all variable, and so on.

Projections for an individual country should as a rule be based on the information pertaining to that country. In the case of newly developing countries, however, the availability of relevant data is usually quite limited, and supplementary information has very often to be obtained from the experiences in other countries. A generalized form of such supplementary information, which may be termed "international reference patterns", is thus one of the particular concerns of the present study. An additional section is, therefore, devoted to exploration of the possibility of building such reference patterns of consumer demand on the basis of data for many countries.

The recent addition to the Development Programming Techniques Series of the Economic Commission for Asia and the Far East (EC AFE)[2] deals with problems of long-term economic projections in general. It covers a much broader problem area than does the present study, though at the expense of technical details. While expounding only a few pages to pass over the area of demand projections in particular, thus EC AFE report does assess at some length the aggregate aspects of

[1] The Food and Agricultural Organization of the United Nations once compiled a *Bibliography on Demand Analysis and Projections* (Rome 1960), covering a number of interesting studies, both theoretical and empirical, in the field of consumer demand, though the literature included is dated no later than 1959 and the selection concentrates rather on agricultural products. Among more recent materials, the symposium of the Association scientifique européenne pour la prévision économique à moyen et à long terme (ASEPELT) on national consumption forecasts deserves particular attention. It includes the most up-to-date experiences and experiments on consumption forecasts in several European countries. The writer of the present report has had the benefit of reading some of the advance copies of the contributions to the symposium.

[2] United Nations, *Problems of Long-term Economic Projections with Special Reference to Economic Planning in Asia and the Far East*, report of the Third Group of Experts on Programming Techniques (Sales No. 63.II.F.6).

long term projections and hence the projections of those macro-economic variables which are referred to simply as "given" or "predetermined" factors in the present study. Besides this difference in scope, it should be noted that these two reports run parallel in placing stress on the use of cross-country comparisons or international reference patterns for economic projections in developing countries. Although specific recommendations relating to estimation problems in this area will have to await further empirical work, it appears highly desirable for the United Nations to extend the study of real incomes and purchasing power parities to many more countries than those covered by the recent studies by the Organisation for European Economic Co-operation (OEEC).[3]

It should be noted that some of the technical problems and devices for the estimation of Engel curves are often applicable to the procedure of estimating projection invariances for non-consumer demand as well. While the invariances in consumer demand projections, expressed in such parameters as income elasticities and price elasticities, concern the stochastic pattern of human behaviour, those in producer demand projections conceived in the form of input-output coefficients and capital coefficients are essentially related to technological constraints of production; yet the latter are not quite identical to pure engineering data but reflect to a great extent the structural and behavioural characteristics of any particular production activities from which such parameters are to be derived. The "anonymity" of so-called technological coefficients in this sense leads, together with the problem of aggregation or stratification, to various technical questions some of which are rather similar to those encountered in the case of consumer demand. For example, proper coefficients for input-output projections may sometimes have to be estimated in terms of an especially designed behavioural model in order to let them subsume the joint effects of underlying socio-economic changes interacting with more obvious technological factors.

Apart from the problem of estimating any particular "technological" parameters, there are in actuality many occasions in which an analogy with household demand behaviour can be useful for the projection of non-household or industrial consumption. The analogy which typically relates the demand for given specific commodities to the behaviour of a more aggregate variable or variables (such as gross domestic product) may not be intended to be a legitimate alternative to more stringent models (such as a detailed scheme of input-output analysis) but may be useful as a first approximation, especially in the context of very long term projections, that can supplement the estimates derived in terms of a less crude model. Many examples of such crude projection schemes are found in those studies concerning more or less global prospects of future demand and supply conditions of specific commodities, undertaken very often in connexion with the work programme of the United Nations family. Major methodological features of these studies will be briefly reviewed in the last section of the present study, "Crude Methods of Projection for Industrial Consumption".

[3] Organisation for European Economic Co-operation, *An International Comparison of National Products and the Purchasing Power of Currencies* by Milton Gilbert and Irving B. Kravis (Paris, 1954) and *Comparative National Products and Price Levels* by Milton Gilbert and associates (Paris, 1958). *See also* Organisation for Economic Co-operation and Development, *International Comparison of Real Per Capita Consumption Levels* by W. Beckerman, Development Centre Studies No. 4 (Paris, 1965) for a fairly extensive collection of the literature in this area.

FORMULATION OF HOUSEHOLD CONSUMPTION PATTERN

Mathematical formulas for Engel curves

For the rational formulation of demand projection it is important to obtain first a well-organized description of actual demand behaviour. The form of description should be concise enough for practical manoeuvrability, by "concise" is meant that a large number of observations can be reduced to a relatively small number of parameters.

There are many factors which are expected to be the causes of variation in the observed patterns; income and prices are the main ones. Other factors such as family size, geographical location, social class and climate may not necessarily be less important, but are not easy to deal with because of the difficulty of linking them to numerically measurable variables (except, say, family size). There are certain formal methods for detecting whether any such factors are important or not in assessing the pattern of demand for a given consumption item; the analysis of variance and the use of dummy variables being the most popular of such means. Leaving aside for the moment the price effects as well as the non-economic factors mentioned above, the problem now is to express the consumption pattern as a function of income, that is, the problem of mathematical formulation of Engel curves.

The general shape of Engel curves can easily be figured out by considering the changing composition of a consumer's basket of goods. When income is low enough to buy only one commodity, the income elasticity for that commodity is naturally equal to unity. If additional commodities are bought as income rises, the income elasticity for the first commodity will gradually diminish, while the items newly introduced into the basket are subject to elasticities that are much higher than unity. Many commodities can thus be supposed to begin life as luxuries and eventually become semi-luxuries or necessities as income increases (and as their

relative prices fall). As long as a commodity is "well behaved" in this sense, the Engel curve for this commodity will take the form of a sigmoid curve.

When the consumption of a new commodity gradually replaces the consumption of an old commodity, the income elasticity for the latter will even become negative, and will finally drop out of the basket after the replacement is completed. This is the phenomenon which is sometimes referred to as a change in the quality of a commodity. To over-emphasize the physical homogeneity of a commodity concept would, therefore, very often lead us into the trap of ill behaved life of the commodity, which would leave the Engel curve discontinuous beyond a certain range of income. When such commodities are aggregated into one composite commodity, qualitative changes within this composite can be taken care of in terms of changes in the average price paid per unit of the composite; the continuity of Engel curves can thus be preserved for a wide range of income when consumption is measured in expenditure units instead of quantity units. Expenditure units do not necessarily have to be monetary units, but when a composite commodity is measured in physical units such as kilogrammes and litres, some conversion ratios relating to the economic equivalences among different kinds of component commodities have to be applied in aggregation, in order not to miss completely the qualitative variation within the composite concept. Allowance for quality variation by measuring consumption in expenditure units will generally tend to make the Engel curve steeper and its asymptote, if any, less pronounced than otherwise.[4]

Considerable experience has been accumulated for the past two decades in determining the mathematical form of Engel curves. It has long been recognized that the linear equation is only a first approximation to describe the Engel curve for a limited range of income groups.[5] A number of alternative non-linear equations have been proposed[6] which have generally provided a better fit to the observed data than the linear equations. Table 1 illustrates the forms of equations most frequently used to estimate Engel curves. Although a polynomial of sufficiently high degree can assume any required shape, the time-consuming effort required to utilize this possibility is seldom justified for least squares fitting, since the degree of scatter is usually too large to allow the precise determination of curvatures, and the resulting estimates of coefficients are likely to be subject to collinearity complications. Determining a precise curvature, *per se*, is one thing, while testing an economically acceptable hypothesis is another; the economic, if not statistical, significance of a higher degree term is rather difficult to assess because it is often confused with the influence of factors other than income.

The forms of equations shown in Table 1 can be fitted to data by the least squares method, though the last two types (9 and 10) require iterative computations. The elasticity coefficients are, in all cases but one (the double logarithmic), variable according to income levels, and in most cases are more or less decreasing functions of income, except in the case of the non-logarithmic linear where the elasticity coefficient approaches to unity from either lower or higher values than unity, depending on the sign of α. Since all these equations are economically meaningful only for the positive values of the variables involved, the non-logarithmic parabola can be valid only over a range of incomes within which the dependent variable assumes positive value.

Ruling out the possibilities of discontinuity and thus assuming the good behaviour of a given composite commodity over a sufficiently wide range of incomes, it would be plausible to have the Engel curve embodying two properties: (*a*) an initial income level y_0, below which the commodity is seldom bought, and (*b*) a saturation level $\bar{c}$ which provides an upper limit to the consumption of the commodity. These two properties imply that income elasticity gradually diminishes as income increases, possibly from values higher than unity down to the ultimate value of zero. The distinction between the luxury stage and the necessity stage of a commodity is usually given with the dividing line provided by an income level at which the elasticity equals unity.

The initial income level (a positive value of y corresponding to the zero value of c) can be explicitly expressed only for some of the equations in Table 1. They are linear ($y_0 = -\alpha/\beta$), inverse ($y_0 = \beta/\alpha$), parabola (y_0 = either of $(-\beta + \sqrt{\beta^2 + 4\alpha\gamma})/2\gamma$ that happens to be positive), semi-log ($\log y_0 = -\alpha/\beta$), and Tornqvist equations for relative luxuries and luxuries ($y_0 = \gamma$). On the other hand, the saturation level of consumption (the value of c corresponding to an infinitely high income) is indicated by the value of α in such equations as inverse, log inverse and Tornqvist's for necessities and relative luxuries, and by the term $\bar{c}$ in the case of log normal. In the Tornqvist equation for luxuries, α denotes the fraction (c/y) at an infinitely high level of y so that there is no saturation level as long as y keeps increasing (the ultimate elasticity being equal to unity).

The first half of the log-log inverse (up to the point where income elasticity diminishes to zero) usually gives a shape very much similar to that of the integral of log-normal distribution, but this peak is followed by a negatively sloped portion with further increase in income, though very gradually, compared to the case of parabolas.

The log-normal demand equation is usually written in a more concrete form such as:

$$(9') \qquad c/\bar{c} = \int_{-\infty}^{t} \frac{1}{\sqrt{2\pi}} e^{-t^2/2}\, dt$$

where $t = \ln\alpha + \beta \ln y$.

[4] This assumes that an index of quality for a composite commodity is an increasing function of income.

[5] See, for example, R. G. D. Allen and A. L. Bowley, *Family Expenditure*, first edition (London, 1935).

[6] See especially, S. J. Prais and H. S. Houthakker, *The Analysis of Family Budgets*, first edition (Cambridge, 1955) and J. Aitchison and J. A. C. Brown, *The Lognormal Distribution*, first edition (Cambridge, 1957).

Table 1

MATHEMATICAL FORMS OF ENGEL CURVES

Equation	Expression for β
1 Linear ($c = \alpha + \beta y$)	$\gamma = \gamma + \alpha \beta$
2 Inverse ($c = \alpha - \beta \gamma$)	$\beta \quad \alpha\gamma \quad \beta$
3 Parabola ($c = \alpha + \beta y - \gamma y^2$)	$\beta \quad 2\gamma\gamma \quad \beta \quad \gamma\gamma + \alpha \gamma$
4 Double log ($\log c = \alpha + \beta \log y$)	β constant
5 Semi log ($c = \alpha + \beta \log y$)	$\beta \quad \alpha + \beta \log \gamma$
6 Log inverse ($\log c = \alpha - \beta \gamma$)	$\beta \gamma$
7 Log log inverse ($\log c = \alpha - \beta \gamma - \gamma \log y$)	$\beta \quad \gamma\gamma \quad \gamma$
8 Log parabola ($\log c = \alpha + \beta \log y - \gamma \log y$)	$\beta \quad 2\gamma \log \gamma$
9 Log normal ($c = \Lambda \alpha\gamma^{\beta}$)	$\beta\Lambda \alpha\gamma^{\beta} \quad \Lambda \alpha\gamma^{\beta}$
10 Tornqvist system	
Necessities ($c = \alpha\gamma \quad \gamma + \beta$)	$\beta \quad \gamma + \beta$
Relative luxuries ($c = \alpha\gamma \quad \gamma \quad \gamma + \beta$)	$\beta \quad \gamma + \beta + \gamma \quad \gamma \quad \gamma$
Luxuries ($c = \alpha\gamma \quad \gamma \quad \gamma + \beta$)	$1 + \beta \quad \gamma + \beta + \gamma \quad \gamma \quad \gamma$

and ... tenor consumption of a given commodity, income, and income respectively, per consumer unit (person or family) ... for notation to be specified further on; the stage whether consumption is measured in physical quantities or in expenditure, although the possibility of choosing among these alternative forms of equations are certainly greater when consumption is measured in physical quantities; that otherwise α, β and γ are constant parameters to be estimated, β and γ are supposed to assume positive values (though not necessarily so in the case of the non-logarithmic parabola), while the sign of α depends on the equation; the expression for the log normal function are explained in the text.

In this formula, a consumption level relative to its saturation level is expressed as the integral of the standardized log normal distribution function (with zero mean and unit variance). This integral is commonly referred to as Cameron integral, the value of which is readily available in tabulated form for various values of t.[1] α is a locational parameter determining the position of the curve on the horizontal axis, or the scale on which income is to be measured for each consumption item; the parameter β, on the other hand, concerns the vertical scale and thus influences the shape of the normal distribution curve (the lower the value of β, the more flattened is the curve). Once a saturation level c is determined, the parameters α and β can be estimated by a simple regression of the values of t corresponding to observed values of c/c upon $\log y$. Without recourse to the maximum likelihood method, the acceptability of a guessed value of the saturation level may be judged by the straightness of this regression line.[2]

The income elasticity at any given income level can be obtained simply as

$$\frac{d \log c}{d \log y} = \frac{\beta \Lambda(t)}{\Lambda(t)}$$

where $\Lambda(t)$ designates the area and $\lambda(t)$ the ordinate

[1] See R. A. Fisher and F. Yates, *Statistical Tables*, third edition (London, 1949), table IX for the integral and table II for the ordinate of the log normal distribution function or, for example, Area, Ordinate and Derivatives of the Normal Curve of Error," *Mathematical Tables from Handbook of Chemistry and Physics* tenth edition (Cleveland, Ohio, 1954), pages 399 to 213.

[2] Any systematic curvature in the array of points plotted on a scatter diagram is an indication that the guessed value of c is either too high or too low. For the maximum likelihood method of estimating the three parameters, c, α, and β, see J. Aitchison and J. A. C. Brown, op. cit.; the method varies depending on whether the random error is introduced as an additive term or as a multiplicative term.

of the log normal distribution function at the value of $t = \ln(x/\lambda)/\beta$.

Experience shows that no serious error results from approximating β by unity, so that, instead of (9') the two parameter log normal demand equation

$$(9'') \qquad c = \Lambda \alpha\gamma^{1}$$

is almost equally useful. In this simple form, α determines the scale on which income is to be measured for each individual commodity, since the vertical scale for different commodities differs only by the scalar factor $1/\alpha$ in (9''). It is equivalent to the statement that there is a single basic Engel curve that can be adapted to different commodities simply by changing the units of measurement for income. The parameter α is sometimes called parameter of elasticity because it controls the degree to which a consumer with a given income can approach his saturation expenditure for a given commodity.

In practice no serious divergence may be found between the estimates of consumption levels obtained from the cumulative log normal and those obtained from the Tornqvist system, except that the latter involves a somewhat rigid connection between necessities and luxuries. In fact, the cumbersome mechanism in the Tornqvist system can be avoided by reducing its basic equation (of a hyperbolic form) into a form equivalent to the logistic curve, which is as flexible as the cumulative log-normal in its parameter structure, namely:

$$(10') \qquad c = \int_{-\infty}^{z} \frac{e^{z}}{(1 + e^{z})^{2}} dz$$

where z is the so-called "logit" and given, for example, by:

$$z = \alpha + \beta \ln \gamma.$$

[3] See P. R. Fisk, "Maximum Likelihood Estimation of Tornqvist Demand Equations," *Review of Economic Studies* vol. XX, No. 1 (Edinburgh, 1958), pages 33 to 45. The values of z (logit)

The Tornqvist curve, thus modified into the logistic, is sigmoid in shape, continuous for the range of incomes from zero to infinity, just as is the cumulative log normal. The procedure of estimating the set of parameters involved is also very much similar to that of the cumulative log normal.

For the original form of the Tornqvist equations, on the other hand, no strict method is available to estimate all the parameters in the system with equal efficiency. The method ordinarily used is essentially an iterative trial and error process of least squares. Alternative values of β (that determine the curvature or the speed with which the saturation level is reached) are arbitrarily chosen and the corresponding values of α and γ are obtained by least squares; among the alternative sets of estimates for these parameters, the one which minimizes the error variance

$$V = \Sigma\ c - F\ c^{-1/2},$$

where $F(c)$ is the expected value of c obtained from each regression, has to be sought.[11] However, the efficiency of such estimates is not exactly known, nor can the degree of bias, if any, in the estimation be known.

Selection among alternative formulas

The selection among the various forms of equations depends on many things, besides the pure utility characteristics of consumption items; in summary, the most important are:

(i) Composite characteristic of a given commodity concept;

(ii) Measurement of the amount of consumption (in physical quantities or in expenditure);

(iii) Range of income levels to be considered, which in turn depends on the type of data to which a curve is to be fitted. The range is much greater in the case of cross-sections derived from consumer budget survey data than in the case of time series data (relating most typically to national aggregates), even a greater range than the former can be covered in the analysis of cross-country variations of national average data;

(iv) The extent to which the observed variations of consumption are abstracted from the influences of factors other than income; and

(v) Computational simplicity.

Good fit is, needless to say, the key technical criterion by which the actual suitability of a supposedly plausible type of equation is judged. By this criterion, some otherwise plausible types, particularly the non-logarithmic linear, hyperbolic and parabolic, usually get a rather low score. The double-logarithmic (constant elasticity) is most often satisfactory for nearly all non-food categories of consumption, when the latter is expressed in terms of expenditures rather than quantities, and when the income range is not too wide. The semi-logarithmic is the simplest that will do for most food stuffs, though without giving any ceiling expenditure. When consumption is expressed in quantities and the commodity considered is of a less composite nature, asymptotic formulas will generally give a better fit. The log-inverse is the simplest among such formulas, but the log normal, which requires a more laborious work for exact fitting, is used almost as frequently for it has three parameters and hence involves more flexible characteristics. The Tornqvist system has attracted relatively little attention, except in Sweden, where it has been used fairly extensively,[12] although it involves both an initial income level and a saturation level; this is mainly because no strict method is available for estimating all the parameters in the system with equal efficiency. The log-log inverse form appears rather frequently in the studies of the Food and Agriculture Organization (FAO) relating especially to the consumption of cereals or, more generally, of carbo-

and its integral $P(\gamma)$ are readily available in tabulated form as in the case of the log normal, for example, in table VII in Fisher and Yates, op. cit.

[11] Although each alternative value of β is introduced as an *a priori* postulate, the value has to be obtained, to begin with, as a preliminary estimate based on actual observations. J. G. van Beeck and H. den Hartog, for instance, suggest the following method in their "Consumption Forecasts for the Netherlands" (an article to be presented in volume 2 of the forthcoming ASEPELT publication): choose arbitrarily three (or two in the case of necessities) equidistant income levels and obtain the corresponding consumption levels from a free-hand graphic interpolation; then by inserting these pairs of observations (c_1, y_1), $(c_2, 2y_1)$ and $(c_3, 3y_1)$ into the original Tornqvist equations (as shown in table I), β can be solved in terms of these inserted values; it will then be seen that the curvature parameter β is determined by the first and second differences of the values given for c in the case of relative luxuries and by the second and third differences in the case of luxuries; a given consumption item can thus be classified into either of these two categories according to the sign of the second difference, that is $(c_1 - c_2) - (c_2 - c_3)$, which is positive for luxuries and negative otherwise.

[11] To the above list might be added the "additivity criterion", that is, fulfilment of the condition that if the Engel curves for a number of items of consumption (expressed in expenditures) are described by the same type of equations, the sum of the expenditures on all commodities (including savings) should be identically equal to income. This condition is easily satisfied (if a restriction is so placed on the constants of the formula in the process of estimation) only in the case of linear Engel curves and a few other special types, such as an ascending polynomial function of income which passes through the origin, but certainly not by the double-logarithmic, neither the semi-logarithmic nor the log normal do too well in this respect. However, there are categories of expenditure, such as entertainment and the hybrid "all other expenditures" of family budget schedules, whose income elasticities hardly diminish no matter how wide the range of incomes considered; this suggests, for one thing, that there is in fact no real ground for supposing that all Engel curves should be described by the same type of formulas. It may thus be safe to ignore this criterion for practical purposes.

[12] The original article by L. Tornqvist was presented as "Review Article" in *Ekonomisk Tidskrift*, vol. 43 (Stockholm, 1941), pages 216 to 225; for examples of its application, see, for example, H. Wold and L. Jureen, *Demand Analysis*, first edition (New York, 1953) and also L. Jureen, "Long-term Trends in Food Consumption: A Multi-country Study," *Econometrica*, vol. 24 (New Haven, Conn., 1956), pages 1 to 21. More recently, the Tornqvist system has been given a strong advocacy by J. G. van Beeck and H. den Hartog in their "Consumption forecasts for the Netherlands," op. cit.

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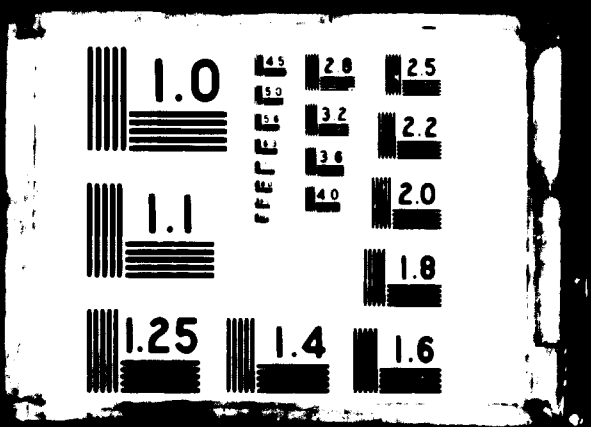

hydrates.[13] In dealing with the demand for manufactured goods (even food), the case for applying such a formula would hardly arise.

Generally speaking, for the description of the behaviour of traditional items of consumption, it is more important to detect the saturation level than the initial income level; rather the reverse is true, however, for less traditional types of commodities which consist mostly of manufactured products. Thus, in the case of non-food items of consumption, the estimates of saturation levels tend to be quite high compared to the currently observed levels of consumption. For example, by applying the two-parameter log-normal equation to the budget data of industrial working-class households in the United Kingdom, the proper estimates (not guesses) of saturation levels turned out to be such that even the lowest-income group in the sample was more than half way to saturation in the case of farinaceous food, whereas even the highest-income group was barely half way to saturation in the case of expenditure items other than food and clothing and not even one-twentieth of the way in the case of durable household goods.[14]

Fitting various forms of equations to the same set of data (derived, for example, from a consumer budget survey) has often revealed that the differences among the estimates obtained from alternative equations are the least around the mean-income level, although at incomes away from the mean level the estimated levels of consumption and also income elasticity deviate markedly from one equation to another.[15] For projection purposes, this implies that the choice of equations would not be such an important matter if projections were based only on future changes in the mean-income level, that is, if no appreciable changes were foreseen in the income distribution for the group of consumers considered. Of course, for a commodity or expenditure item the income elasticity of which varies only slightly within a given range of variation in income, an application of asymptotic formulas, such as log-normal, Törnqvist's, log-inverse, and so on, may be expected to give results that are not too different from those resulting from the application of a double-logarithmic equation.

Table 2 serves as an illustration of this point. The data were taken from the Italian consumer budget survey of 1953, which involved 1,599 Italian families, classified into eleven classes according to annual *per capita* total expenditure levels, and a highly detailed classification of consumption categories, especially for non-food items.[16] Column (1) indicates the least squares estimates of elasticities with respect to total *per capita* expenditure obtained by applying the double-logarithmic formula to all consumption categories. Regression fit was quite satisfactory, R^2 being no less than 0.95 in almost all cases. The regressions were applied to the grouped data (with eleven observations for each category) without weighting them according to the number of persons included in each class: the resulting estimates thus seem to be slightly biased towards the high-income classes compared to what would obtain if the observations were weighted.[17] Columns (2) to (4) were derived from the estimators of the log-normal equations which were readily available from the study of the Associazione per lo Sviluppo dell' Industria nel Mezzogiorno (SVIMEZ);[18] the form of equation employed is the same as that indicated in table 1, but the saturation levels, which are shown in column (5) of table 2, are the approximations obtained by graphical methods and not maximum likelihood estimates. Average levels of total *per capita* expenditures for the second lowest class and the second highest class are 102,200 and 601,200 lire, respectively; the population mean in column (4) refers in fact to the national average for the year 1958 (203,700 lire in 1953 prices), and not to the sample mean.

The elasticity coefficients are quite similar between columns (1) and (4), though the former are generally a little lower than the latter, reflecting in part the higher mean income of the sample, as compared with the mean for the nation. The extent to which elasticity coefficients decrease as one moves from the second lowest to the second highest bracket (which implies about a sixfold increase in income) does indeed vary from one category of consumption to another; it appears particularly strong for the categories whose saturation levels are rather low relative to observed expenditure levels, while the variation is weak for the categories with relatively high saturation levels. The levels of expenditures computed from the log-normal equations are shown in columns (6) and (7) as percentages of the assumed levels of saturation. Various consumption categories may be classified into the following four types according to their behaviour patterns in the Italian consumer budgets:

A. With Engel elasticities remaining quite high for all income classes and thus regarded as luxuries throughout the society;

B. With elasticities somewhat lower than the above and yet maintained at such high levels that even in high-income classes expenditures tend to be increased no less

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[13] Food and Agriculture Organization of the United Nations, *Agricultural Commodities—Projections for 1970*, FAO Commodity Review 1962 Special Supplement (Rome, 1962).

[14] R. Stone and G. Croft-Murray, *Social Accounting and Economic Models* (London, 1959), pages 64 and 65. The two-parameter log-normal is less flexible than the three-parameter log-normal, and when applied to the same data the former seems to give, more often than not, a lower estimate of saturation level than does the latter.

[15] *See*, for example, the results obtained by applying this kind of exercise to *per capita* consumption of fresh fruit (measured in kilogrammes on the basis of the data taken from the Austrian survey for 1954/55, as reported in L. M. Goreux in "Income and Food Consumption", Food and Agriculture Organization, *Monthly Bulletin of Agricultural Economics and Statistics*, vol. IX, No. 10 (Rome, 1960).

[16] Expenditures are all expressed in 1953 lire. *See* Associazione per lo Sviluppo dell' Industria nel Mezzogiorno (SVIMEZ), *Stime sui consumi privati in Italia nel prossimo decennio*, Serie "Ricerche" 2 (Rome, 1960), appendix table I, pages 42 and 43.

[17] The geometric mean over the eleven classes of annual total *per capita* expenditures in the sample is 274,000 lire, whereas the arithmetic mean for the nation remains no more than 203,700 lire even in 1958.

[18] SVIMEZ, op. cit., appendix table III, pages 46 and 47.

Table 2

AN ANALYSIS OF THE ITALIAN CONSUMER BUDGET DATA FOR 1953

Consumption expenditure items	Elasticity with respect to total expenditure: By double-log equations (1)	By log-normal equations as at the income of: Second lowest bracket (2)	Second highest bracket (3)	Population mean (4)	Assumed levels of saturation (thousands of lire) (5)	Computed levels as percentage of saturation levels for: Second lowest bracket (6)	Second highest bracket (7)	Type of consumption items (8)
All foods	0.604	0.747	0.521	0.657	800	7.64	23.58	D
Beverages	0.747	1.315	0.290	0.836	21.5	22.06	83.65	C
Tobacco	0.788	1.193	0.485	0.890	20	14.00	59.87	C
Clothing and textiles	1.188	—	—	—	—	—	—	
Underwear	1.215	1.363	1.111	1.296	1,000	0.11	0.99	B
Hosiery and stockings	1.092	1.302	0.929	1.157	150	1.02	7.35	C
Thread	0.747	0.686	0.628	0.677	500	0.12	0.39	D
Ready-made clothing	1.432	1.669	1.155	1.457	1,000	0.41	5.05	B
Shoes	0.693	0.774	0.661	0.731	800	0.45	1.58	D
Cotton fabrics	0.741	0.708	0.657	0.675	2,500	0.03	0.10	D
Wool fabrics	1.270	1.548	1.190	1.344	100	1.02	9.85	B
Silk and other fabrics	1.471	1.634	1.288	1.548	250	0.03	0.91	B
Clothing accessories	1.533	1.728	1.342	1.581	1,000	0.03	1.04	A
Alterations to clothing	1.703	1.779	1.341	1.618	150	0.10	1.66	A
Housing	1.194	1.365	1.145	1.325	3,000	0.08	0.78	B
Fuel and electricity	0.856	0.960	0.663	0.897	1,000	0.48	2.27	D
Consumer durables	1.613	—	—	—	—	—	—	
Furniture	1.683	1.882	1.486	1.635	3,000	0.02	0.33	A
Electrical appliances	2.014	2.279	1.503	1.971	200	0.13	3.75	A
Glassware and ceramics	1.300	1.653	1.166	1.347	1,000	0.02	0.23	B
Kitchen-ware	1.265	1.455	1.146	1.382	1,000	0.02	0.21	B
Mattresses, carpets, curtains	1.706	1.842	1.442	1.657	500	0.03	0.54	A
Non-electrical heating equipment	1.640	1.747	1.391	1.612	1,500	0.04	0.66	A
Other products of mechanical industries	1.341	1.873	0.758	1.481	8	4.75	47.00	B
Non-durables	0.797	—	—	—	—	—	—	
Soap, detergents, etc	0.460	0.594	0.473	0.514	100	1.25	3.07	D
Wax and polishes	0.849	0.997	0.809	0.958	50	0.40	2.02	D
Household linen	1.004	0.959	0.857	0.941	2,000	0.05	0.26	D
Other domestic goods	0.609	0.765	0.671	0.709	250	0.05	0.19	D
Hygiene and health	1.071	—	—	—	—	—	—	
Toilet articles	1.169	1.486	0.945	1.272	50	1.66	14.23	C
Drugs and medical services	1.005	1.170	0.801	1.022	70	2.22	12.71	C
Transportation	1.940	—	—	—	—	—	—	
Purchase of vehicles	2.120	2.888	1.733	2.310	10,000	0.01	0.26	A
Operation of private vehicles	2.070	2.666	1.749	2.304	500	0.05	2.38	A
Other services of transportation	1.458	1.776	1.315	1.533	1,000	0.07	1.04	A
Communication	2.052	2.837	1.259	2.186	10	0.75	26.76	A
Recreation and culture	1.418	—	—	—	—	—	—	
Books, newspapers	1.317	1.658	1.079	1.426	100	0.89	9.85	B
Entertainment	1.519	1.918	1.180	1.610	100	0.69	10.56	B
Other (toys, etc.)	1.372	1.414	1.137	1.269	100	0.05	0.48	B
Other services and taxes	1.767	2.720	1.477	1.865	2,500	0.11	2.62	—
Subsidies in money	2.329	2.518	1.705	2.270	100	0.08	3.59	—

Source: SVIMEZ, *Stime sui consumi privati in Italia nel prossimo decennio*, Serie «Ricerche» 2.

than proportionately to increases in income; one may term this type, semi-luxuries;

C. Semi-necessities, so to speak, in the sense that elasticities decline below unity as one moves to high-income classes and that, for the society as a whole, expenditures increase nearly proportionately to income increases;

D. Necessities with elasticities remaining low for all income classes so that for the society as a whole expenditures increase significantly less than proportionately with income increases.

If we examine columns (6) and (7) against these categories, we notice some odd cases where the magnitude of Engel elasticity is not quite reflected in the consumer's actual positions relative to the assumed level of satura-

tion. One would generally expect that for consumption items of types C and D the society would be a relatively short way from saturation, while for types A and B it would be a relatively long way to saturation. The saturation levels assumed in the SYMEZ study thus seem to be rather inappropriate in some cases. When a saturation level is assumed at an excessively high level, the resulting estimators of the log-normal equation tend to keep elasticity coefficients rather insensitive to income levels, and an excessively low assumption for saturation level results in elasticity coefficients excessively sensitive to income levels.

PROBLEMS RELATING TO DIFFERENT TYPES OF DATA

Alternative research techniques

In studying the pattern of household consumption demand, various types of basic data can be distinguished. Among others, the following five may be mentioned:

(*a*) Panel survey data relating to the same consumer during different periods of time;

(*b*) Cross-section data from consumer budget surveys relating to different incomes, during a given period of time and in the same geographical area (for example, a country) within which prices are roughly uniform;

(*c*) Time series (for example, annual) of aggregates for a given area in which prices are roughly uniform for all consumers;

(*d*) Cross-country data relating to aggregates for different areas with different average incomes during a given period of time;

(*e*) Time series of aggregates for a number of areas (global aggregates).

The first one is relatively unexplored in practice due to the difficulty of obtaining such data. The second is the most conventional and is in very wide use; such data are now available for more than fifty countries, though with varying qualities. The third is almost equally popular and is used as a substitute for the first type even though it involves serious statistical difficulties, some of which remain to be solved. The use of the fourth type of data becomes increasingly popular particularly in the research scheme related to economic development where international comparison provides the crucial frame of analysis. The fifth, time series of a global aggregate (by region or semi-regional unit), has most frequently been used in connexion with the work programme of the United Nations and related international organizations concerning, in particular, the projections of future demand and supply on a global basis. The time behaviour of such global aggregates has little direct implication for the analysis of demand pattern in an individual country; as will be discussed in the next section, comparison of type (*c*) data (time series of each individual country) for a number of countries may be more interesting, for that matter.

To see the relation among the five types of research techniques, it is convenient to think of the general demand function

$$c_{ikt} = f(y_{ikt}, p_{kt}, R_{ik}),$$

where c denotes the demand for a given consumption item considered, y income, p the vector of prices of all commodities and R a vector representing individual tastes reflecting factors other than income and prices. The subscript i refers to the consumer, k to the area or country and t to time. It is assumed that all consumers within a given area k pay the same prices and that tastes do not change over time unless a very long-run period is considered. The scheme of research using the different types of data may be summarized as follows:[10]

Type of data	*Subscript* i (*consumer*)	*Subscript* k (*area*)	*Subscript* t (*time*)
(*a*) Panel survey	Held constant	Held constant	Variable
(*b*) Budget survey	Variable	Held constant	Held constant
(*a*) and (*b*) Combination	Variable	Held constant	Variable
(*c*) Time series (individual country)	Averaged	Held constant	Variable
(*d*) Cross-country	Averaged	Variable	Held constant
(*c*) and (*d*) Combination	Averaged	Variable	Variable
(*e*) Time series (global aggregates)	Averaged	Averaged	Variable

"Held constant" means that only one value has been considered for the subscript in question so that the influence represented by the subscript is eliminated from analysis. "Averaging" has the same effect if it is assumed that the distribution of all relevant values of the subscript can be adequately represented by its mean; for example, that demand per consumer depends only on income per consumer and not on the distribution of income among consumers. However, the purpose of research is not to

[10] This form of presentation has been borrowed from H. S. Houthakker, *Some Problems in the International Composition of Consumption Patterns*, Research Center in Economic Growth, Stanford University, Memorandum B-10 (Palo Alto, Calif., 1961).

determine the influence represented by a subscript, but to determine the influence of the specified variables, y, p and possibly R, as indicated in the general demand function.

It is to be remembered that the subscript i is omitted from the variable p and the subscript t from R in the above function. This implies that type (b)—consumer budget survey—is not ordinarily used for the analysis of price effects, whereas types (a), (c) and (e) are seldom utilized to reveal the influence of any specific factor other than income and prices, except in the form of autonomous trend whose causal factors remain unspecified. Income effects can be studied by any one of the alternative techniques, though the efficiency of analysis depends on the extent to which they can be abstracted as such from the influences of other factors in a given type of data. The combinations of (a) and (b) and of (c) and (d) involve an application of co-variance analysis. The former combination is actually impossible without having a satisfactory size of panel survey data and it would not be interesting, unless the purpose of research were to study the demand behaviour of an individual consumer rather than that of a group of consumers. But the principle involved in such a combination would help to give an insight into the cumbersome problem of disagreements between cross-section estimates (for example, estimates derived from budget survey data) and time series estimates (for example, those derived from time series of aggregates for a given area). The combination of (c) and (d) may possibly be developed in such a way as to provide an international reference pattern which can be used as supplementary information for the projections in an individual country, especially when an indigenous collection of relevant data is far from sufficient. This approach, though promising, still leaves much to be explored; discussions and experiments along this line will be presented in the next two sections relating to consumer demand and producer demand, respectively.

Use of budget survey data

The statistical estimation of Engel curves (income effects) is most frequently based on cross-section data derived from consumer budget surveys. As mentioned before, it is relatively safe to assume that the consumers included in a given survey are all exposed to the same set of prices, so that the analysis of income effects is possibly free from the disturbing influence of price variations, unlike the case of time series. Some factors other than income can easily be incorporated as additional variables in an equation for an Engel curve if they are numerically measurable and if no serious problem of collinearity arises by introducing them; or, otherwise, other factors can still be treated by means of stratified samples, which will be discussed a little later.

In dealing with consumer survey data, total expenditure (*per capita* or per family) is very often used as the independent variable instead of income, since survey data usually do not report the incomes of households. If expenditure on a given item becomes particularly high, there is automatically an increase in total expenditure. In other words, both dependent and independent variables are endogenous to the consumer and are determined simultaneously.

The classical method of least squares may possibly lead in such circumstances to biased estimates of the true parameter.[20] It is possible to eliminate the bias by introducing income as an instrumental variable. This can be done by computing first the regression of a given expenditure item upon income (as recorded in survey data separately from total expenditure) and then dividing the resulting regression coefficient by the coefficient obtained for the regression of total expenditure upon income. N. Liviatan, who proposed this method, applied it to the data from the British and the Israel surveys.[21] In both cases, the ordinary least squares estimates of elasticity for household durables and clothing were found to be upward biased, whereas those for other expenditure items were found to be downward biased. This would imply that, at least in the short run, expenditures on durables are strongly affected by factors other than current disposable income. In judging the importance of this source of bias it is necessary to compare it with the errors arising from other sources, such as pure sampling errors, incorrect choice of an equation form and insufficient isolation of the influence of other factors. These other sources of estimation bias may possibly be of greater importance than the particular source considered. In any event, the less aggregative the dependent variable, the smaller the bias from this source.

If a budget survey is large enough to cover various races, occupations, communities, and the like, a given form of demand equation can be fitted to each of the strata obtained by cross-classifying the data by income and by group (race, occupation, and so forth). The test of parallelism and coincidence will then help detect whether the

[20] For the purpose of demonstration, suppose that an Engel curve is represented by a linear system such as:

$$c_i = \alpha_{0i} + \alpha_{1i}\hat{y} + u_i$$
$$c = \Sigma_i c_i = \alpha_0 + \alpha_1 \hat{y} + u$$

and $\hat{c} = \alpha_0 + \alpha_1 \hat{y}$,

where c_i denotes expenditure on the i th item, $\hat{y}$ "true" income and $\hat{c}$ the part of c that is systematically consistent with $\hat{y}$. Even though the relationship to be determined is:

$$\hat{c}_i = \beta_{0i} + \beta_{1i}\hat{c},$$

the estimation from the observed variables of c_i and c refers to:

$$c_i = \beta_{0i} + \beta_{1i}c + (u_i - \beta_{1i}u).$$

This involves a linear combination of the two error terms which is correlated with c itself. In this case the ordinary least squares procedure gives a biased estimate of β_{1i}, except in the special case when the regression coefficient of u_i (the error in c_i) on u (error in c) happens to equal the regression coefficient of c_i on c. *See* R. Summers, "A Note on Least Squares Bias in Household Analysis", *Econometrica*, vol. 27 (New Haven, Conn., 1959), pages 121 to 129.

[21] N. Liviatan, "Errors in Variables and Engel Curve Analysis", *ibid.*, vol. 29 (1961), pages 336 to 362. Income in the recorded form may not represent the true income as such and thus not be appropriate as an independent variable, but it can be an efficient instrumental variable because of its relatively close correlation with the true income.

differences of regressions among different strata are actually significant or not. If both slopes and positions of regressions prove to be statistically insignificant, the particular factor considered can be neglected and efficient estimation obtains for all strata combined as a single homogeneous sample. The test involves the analysis of co-variance and can be summarized as follows.

Suppose that a linear relationship between y and x,

$$y_{ij} = \alpha + \beta x_{ij} + u_i,$$

is to be estimated by the least squares method from the data composed of several strata; in the above expression, y_{ij} and x_{ij} designate observations relating to consumer i in stratum j:

$$j = 1, \ldots\ldots, k$$
$$i = 1, \ldots\ldots, n_j$$
$$N = \Sigma_j\, n_j.$$

Three kinds of estimates can be obtained under three different assumptions.

(*a*) Individual regressions: assuming that each stratum has its own slope coefficient and constant term,

$$\hat{y}_{ij} = \hat{a}_j + \hat{b}_j x_{ij},$$

which gives the sum of unexplained variations,

$$\Sigma_j \Sigma_i (y_{ij} - \bar{y}_j)^2 - \Sigma_j \hat{b}_j \Sigma_i (y_{ij} - \bar{y}_j)(x_{ij} - \bar{x}_j);$$

(*b*) A slope-combined regression, assuming that at least the slope coefficient is common to all the strata even though each stratum has its own constant term,

$$\hat{y}'_{ij} = \hat{a}'_j + \hat{b}_c x_{ij},$$

which gives an unexplained variation,

$$\Sigma_j \Sigma_i (y_{ij} - \bar{y}_j)^2 - \hat{b}_c \Sigma_j \Sigma_i (y_{ij} - \bar{y}_j)(x_{ij} - \bar{x}_j),$$

and, finally,

(*c*) An over-all regression, assuming that the data are all homogeneous, i.e. that there is no stratum effect.

$$\hat{y}''_{ij} = \hat{a}_0 + \hat{b}_0 x_{ij},$$

which gives an unexplained variation,

$$\Sigma_j \Sigma_i (y_{ij} - \bar{y})^2 - \hat{b}_0 \Sigma_j \Sigma_i (y_{ij} - \bar{y})(x_{ij} - \bar{x})$$

Note that the sum of squares and cross-products in (*a*) and (*b*) are computed around the means within each stratum $\bar{y}_j$ and $\bar{x}_j$, while those in (*c*) are computed around the over-all means $\bar{y}$ and $\bar{x}$. The analysis of variance, in which the tests of difference of regressions (parallelism test) and difference of positions (coincidence test) are combined, may be set out as follows:

	Degree of freedom	*Variation*
Combined residual	$N-(k-1)$	Sum of unexplained variation (*a*)
Difference of regressions: increase in unexplained variation due to assumption (*b*)	$(k-1)$	Unexplained variation (*b*) *minus* unexplained variation (*a*)
Difference of positions: further increase in unexplained variation due to assumption (*c*)	$(k-1)$	Unexplained variation (*c*) *minus* unexplained variation (*b*)
Over-all regression	1	$\hat{b}_0 \Sigma_j \Sigma_i (y_{ij} - \bar{y})(x_{ij} - \bar{x})$
Total variation	$N-1$	$\Sigma_j \Sigma_i (y_{ij} - \bar{y})^2$

The mean variation in difference of regressions and in difference of positions can be tested against the mean combined residual. Of course, it is not necessary to test difference of positions if difference of regressions is in fact significant. When stratum effects are significant only in terms of difference of positions, it remains to be investigated whether they reflect the real difference in consumption habits among strata or rather differences in factors such as family size and relative price structure.

In the case of newly developing countries, such analysis is especially important as regards the differential demand patterns of urban and rural families. Table 3 presents the results of analysis of a recent consumer survey in Morocco. The elasticities were estimated by fitting log-linear demand equations to the cross-sections of urban and rural households separately; both dependent and independent variables were expressed in terms of their money values per consumer unit, the latter variable being total expenditure instead of income per consumer unit.[22] Budget proportions shown in the table refer to those obtained from the observed values for total families in each group. The rural sample is composed on the average of much poorer families than the urban sample, as is obvious from the budget proportions for various expenditure items. Although the proportion of food expenditure is much higher in the rural group than in the urban group, the value of elasticity does not, on the whole, differ too much between them; this reflects the high autoconsumption of agricultural products, especially milk, cheese, vegetables and fruits in rural families; the elasticities for these particular goods

[22] Size effect was neglected in the analysis. The number of consumer units per family tended in fact to decrease as the total expenditure per consumer unit increased; thus, to the extent that economy of scale exists for some expenditure items (especially housing), the real expenditure elasticities adjusted to the size factor would be lower than the values actually estimated.

Table 3

CONSUMPTION ELASTICITIES WITH RESPECT TO TOTAL EXPENDITURE (URBAN AND RURAL FAMILIES): 1959/60 SURVEY OF MOROCCAN MOSLEM HOUSEHOLDS

Expenditure item	*Elasticity coefficient*		*Budget proportion (percentage)*	
	Urban	*Rural*	*Urban*	*Rural*
Food and beverages, total	0.90	0.88	59.7	75.9
Clothing, total	1.40	1.15	7.6	8.1
Tailored clothes	1.45	1.15	4.1	5.2
Underwear and hosiery	1.65	1.35	1.2	0.6
Fabrics	1.55	1.15	0.2	0.3
Footwear	1.20	1.15	2.0	1.4
Other	1.40	1.05	0.2	0.7
Housing, total	0.85	1.35	18.5	5.3
Rent and maintenance	0.85	2.15	11.5	0.7
Light, fuel and water	0.70	1.00	5.8	2.1
Furniture and fixtures	1.85	1.50	0.7	1.7
Hardware	1.30	1.20	0.3	0.7
Household utensils	0.90	1 65	0.2	0.1
Hygiene and care, total	1.15	1.15	4.9	2.3
Transportation, private	2.75	2.80	2.0	0.5
Transportation, public	1.50	1.75	0.6	1.0
Tobacco	0.75	1.25	1.7	0.9
Recreation	1.60	1.10	0.8	0.7
Miscellaneous	1.60	1.80	4.1	5.3

Source: Ministère de l'économie nationale, Service central de statistiques, *La Consommation et les dépenses des ménages marocains musulmans (Résultats de l'enquête 1959/60)* (Rabat, 1961), pages 182 to 203.

turn out to be much lower in rural families than in urban families, while the reverse is true for other types of food. As regards non-food items, a strong contrast is observed between clothing and housing expenditures: the rural expenditure on clothing is characterized by the relatively low-slope coefficient at the relatively high position while the reverse applies to the rural expenditure on housing. Although no formal analysis has been applied, the heterogeneity of the two strata seems to be quite significant in terms of both elasticity coefficients and positions of regressions for many items of consumption, and the differences are in most cases concordant with what would usually be expected.

For the family budget data of non-agricultural households in France,[23] for example, a fuller form of tests has been applied in terms of two kinds of stratification: size of community and occupational category. The results for non-food items are summarized in table 4. The same form of equation (log-linear) was applied to all the non-food expenditure items, the only independent variable being total consumption expenditure per unit of consumer (and thus not explicitly taking into account family size).

Table 4 reveals that non-agricultural households are on the whole rather homogeneous, showing similar patterns of expenditure both among communities of different sizes and among different occupational categories. In fact, transportation and vacation is the only case in which the difference of regressions remains quite significant as regards both community size and occupation. This may not be so if transportation is separated from vacation; actually further analysis indicates that there is a high degree of homogeneity for public transportation (and communication), at least among occupational strata if not among community strata; the accessibility to public transportation becomes greater as one moves from rural communities to larger urban communities. Hygiene and care and clothing *almost* pass the parallelism test (they do in fact at the 90 per cent confidence level). As for clothing, the relatively low estimates of elasticity coefficients for craftsmen and wage earners conform with common sense; among the rest of the occupational strata differences are quite negligible, however.

In the above analysis, community size effects and occupation effects are not freed from each other since the population of each occupational group is unequally distributed among the community strata. Besides, the distribution of households according to family size varies from one type of community to another. The precision of analysis would be enhanced by deriving more homogeneous sub-samples from the data cross-classified according to community size and occupation and also by introducing family size as an additional variable in the estimation equation.

INCOME DISTRIBUTION

Estimating consumption functions is one thing, but applying them for projection purposes is another. If an analysis succeeds in estimating a consumption function

[23] Conducted in 1956 by the Institut national de la statistique et des études économiques (INSEE) and the Centre de recherches et de documentation sur la consommation (CREDOC), covering some 18,000 non-agricultural households.

Table 4

ELASTICITIES WITH RESPECT TO TOTAL EXPENDITURE BY SIZE OF COMMUNITY AND BY OCCUPATION: NON-AGRICULTURAL HOUSEHOLDS IN FRANCE, 1956

Item	*Clothing*	*Rent and maintenance*	*Household equipment*	*Light and fuel*	*Hygiene and care*	*Transportation and vacations*	*Cultural and recreational*	*Other "non-food"*
By size of community								
Rural communities	1.19(0.18)	1.19(0.36)	1.62(0.18)	0.61(0.15)	0.75(0.19)	3.31(0.43)	1.45(0.24)	1.25(0.44)
Urban communities with less than 10,000 inhabitants	1.34(0.15)	1.46(0.31)	1.61(0.38)	0.71(0.21)	1.05(0.33)	3.10(0.44)	1.63(0.22)	1.09(0.73)
Urban communities with 10,000 to 100,000 inhabitants	1.28(0.13)	1.39(0.26)	1.67(0.30)	0.62(0.15)	0.79(0.15)	2.69(0.37)	1.62(0.18)	1.62(0.40)
Urban communities with over 100,000 inhabitants	1.39(0.14)	1.23(0.33)	1.59(0.24)	0.43(0.13)	1.18(0.21)	2.61(0.30)	1.77(0.21)	1.64(0.26)
Agglomeration of Paris	1.32(0.11)	1.33(0.20)	1.57(0.26)	0.45(0.11)	0.90(0.14)	2.24(0.20)	1.51(0.16)	1.71(0.37)
"Combined", for all communities	1.29(0.06)	1.30(0.14)	1.61(0.12)	0.55(0.07)	[a]	[a]	1.58(0.10)	1.50(0.20)
By occupation[b]								
Craftsmen and shopkeepers	1.07(0.28)[c]	1.28(0.26)	1.10(0.38)	0.81(0.20)	0.91(0.40)	2.20(0.44)	1.34(0.27)	0.82(1.52)
Professionals, senior executives, etc.	1.32(0.18)	1.52(0.31)	1.09(0.78)	0.83(0.20)	1.03(0.50)	1.55(0.42)	1.09(0.41)	1.96(2.04)
Junior executives, etc.	1.26(0.24)	1.46(0.26)	1.60(0.47)	0.70(0.24)	1.13(0.34)	1.72(0.22)	1.31(0.24)	2.31(0.88)
White collar workers	1.34(0.14)	1.40(0.40)	1.50(0.40)	0.73(0.14)	1.30(0.27)	1.45(0.34)	1.42(0.26)	1.56(0.44)
Wage earners	1.09(0.10)	1.41(0.22)	1.51(0.30)	0.63(0.18)	1.10(0.20)	2.12(0.25)	1.42(0.20)	1.79(0.40)
Inactive	1.35(0.10)	1.16(0.34)	1.65(0.14)	0.67(0.13)	1.01(0.20)	2.91(0.34)	1.45(0.22)	1.69(0.32)
"Combined", for all occupations	[a]	1.31(0.12)	1.50(0.14)	0.69(0.07)	1.06(0.11)	[a]	1.39(0.10)	1.68(0.32)

Source: N. Tibard, "Consommation et niveau de vie de quelques groupes sociaux", *Consommation — Annales du Centre de recherches et de documentation sur la consommation* (CREDOC), No. 2, 1961 (Paris), pages 5 to 45.

[a] Difference of regressions is significant at the 95 per cent confidence level.

[b] For the definition of these categories, *see* "Budgets des Français en 1956", *Consommation — Annales du CREDOC*, No. 3, 1959, pages 83 and 84.

[c] Figures in parentheses indicate standard errors of elasticity coefficients.

that is common to all consumers within a given group, it does not follow that all these consumers have equal income levels or that their incomes change all at an equal rate. When the group of consumers considered is so large that its income distribution is not likely to remain unchanged, a reasonable projection would require something more than a simple algebraic procedure of obtaining a future value of average consumption by feeding into the consumption function a future value of average income. The only exception is the case in which an empirically acceptable consumption function happens to be a linear one (No. 1 in table 1); that is, only if a consumption function of the form:

$$c = a + by$$

holds for all consumers, does the following hold:

$$\text{av. } c = a + b\ (\text{av. } y)$$

no matter how y is distributed among these consumers. This is not true, for example, for a log-linear (constant-elasticity) formula, except in the trivial case when the elasticity coefficient equals unity.

Changes in income distribution are indeed closely associated with changes in the occupational distribution of the population, which in turn are associated with changes in production structure; it is by no means an easy job, however, completely to work out these and any other possible causal chains in a manageable scheme of projection.

In India, for example, one of the central concerns of the national perspective planning is to improve an intolerably meagre standard of living on the part of the low-income class, as represented by the fact that at present as much as 80 per cent of the population has a level of consumption lower than the minimum nutritional standard (IRs 35 *per capita* per month) and the lowest two deciles of the population a level equivalent to only one-third of the minimum standard. A plan for doubling the national income in the decade 1965 to 1976, that is, a minimum required rate of growth of 7 per cent ***per annum***, thus

incorporates the assumption that, even though the poorest 20 per cent of the population may possibly remain isolated from the mainstream of economic growth, the third poorest decile should get at least IRs 20 *per capita* per month. For the purpose of projections of household consumption, this and other assumptions relating to changes in income distribution are translated into a change in Lorenz ratio from 0.33 in 1960/61 to 0.25 in 1975/76.[24] This assumed change in Lorenz ratio may be considered reasonable in view of the value of the ratio prevailing in some developed countries and the goal of progressive reduction of inequalities of income and consumption. It is not quite clear, however, whether any particular policy measures have been proposed to ensure this reduction in income inequalities and whether such measures would not obstruct the full realization of the nation's growth potentialities.

Setting aside this difficulty, it is worth noting that the statistical description of income distribution and of its change is computationally a simple matter under the log-normal hypothesis. In economic data such as those relating to the size distribution of personal incomes, consumption expenditures, business concentration, labour turnover, and so on, skew frequency curves are the rule rather than the exception, and there is a great deal of evidence that such skewed distributions can be approximated safely by the log-normal distribution function, that is, the function to describe the distribution of a variate whose logarithm obeys the normal law of probability. The standard form in which this function can be fitted to observed data has already been indicated as one of the devices describing the sigmoid Engel curves.

Let y designate the level of income *per capita* and $N(y)$ the proportion of population with income no greater than that level, the two-parameter log-normal distribution function may then be expressed in its standardized form as

$$N(y) = \Lambda(\alpha y^{\beta})$$
$$\text{or } N(y) = \Lambda(y \mid \mu, \sigma^2)$$
$$= \Lambda\left(y^{1/\sigma}/e^{\mu/\sigma} \mid 0,1\right),$$

where $e^{-\mu/\sigma} = \alpha$ and $1/\sigma = \beta$. The locational parameter μ is the logarithm of the geometric mean income; but the arithmetic mean income m is always equal to

$$m = e^{\mu + \frac{1}{2}\sigma^2}$$

under the two-parameter log-normal hypothesis, and hence involves both the location and dispersion parameters. The dispersion parameter σ can easily be related to the concept of concentration of incomes as expressed by the Lorenz ratio (L) or Gini's coefficient (G), that is,

$$L = 1 - 2\int_0^{\infty} \Lambda(y \mid \mu+\sigma^2, \sigma^2)\, d\Lambda(y \mid \mu, \sigma^2)$$

and $G = 2mL$

[24] This information has been obtained from an unpublished preliminary study of the Perspective Planning Division, Planning Commission of India, entitled, "Perspective of Employment, 1961-1976 — Implications of Planning for a Minimum Level of Living", dated August 1962.

L is monotonically related to the value of σ and is independent of μ. Also, it can easily be verified that under the log-normal hypothesis the proportion of population with less than the mean income m is uniquely related to the value of σ and is independent of the mean-income level itself. The values of L and the proportions of population with less than mean income which correspond to given values of σ are readily available in a tabulated form in Aitchison and Brown's *The Lognormal Distribution*, appendix table A1.[25]

Chart 1 shows income distribution patterns in India for 1960/61 and 1975/76 approximated by the two parameter log-normal and plotted on a logarithmic probability graph. The Lorenz ratio for 1960/61 is assumed to be the same as that estimated from the national sample survey data for 1957/58; the ratio for 1975/76 is, as mentioned before, the prospective assumption made by the Perspective Planning Division of the Indian Planning Commission. Income refers to total expenditure per month *per capita* in 1957/58 prices, and the arithmetic mean is assumed to increase from IRs 25 in 1960/61 to IRs 36.5 in 1975/76. This is all that is required to describe the distribution pattern as long as the log-normal hypothesis is accepted.[26]

Once the total *per capita* expenditure levels of various fractions of population are read off from the prospective pattern of distribution obtained in this manner, projections of demand for goods and services may well be based on the assumption that consumption pattern at any given level of total *per capita* expenditure will remain the same over the period considered. That is to say, applying a set of Engel curves estimated from consumer budget data to each fraction of population and then summing up over all the fractions the resulting estimates of expenditures for each expenditure item would easily give the estimates of average *per capita* demand for the whole population.

[25] Aitchison and Brown's appendix table A1 also gives other measures of dispersion, such as coefficient of variation, coefficient of skewness, coefficient of kurtosis, and so on, tabulated against various values of σ in the two-parameter log-normal distribution function. The following would help to figure out the order of magnitude of σ corresponding to the degrees of inequalities that are frequently observed for the nation-wide income distribution.

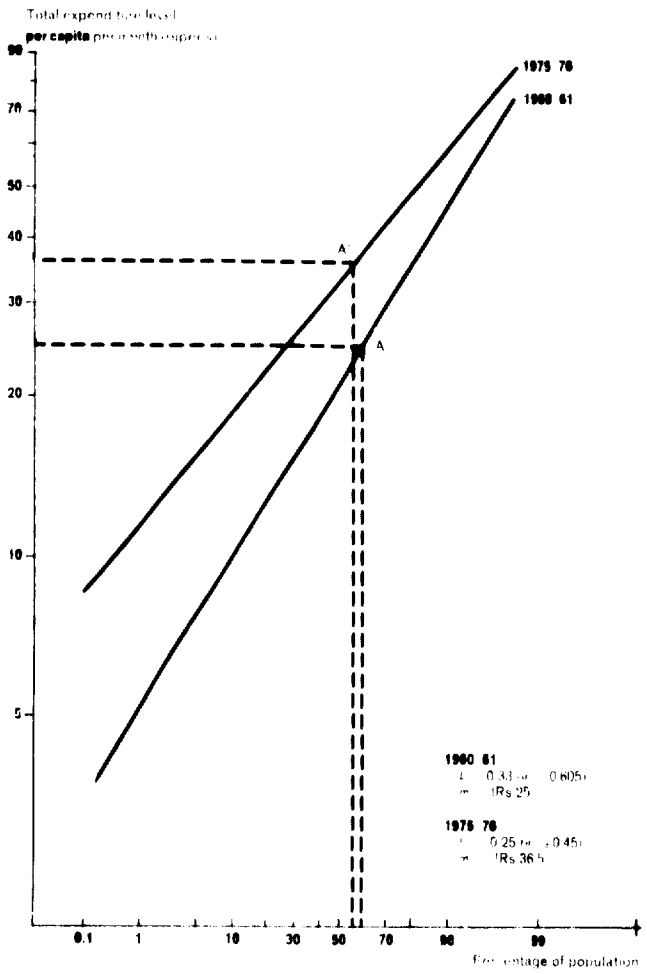
σ	Lorenz ratio L	Proportion of population with income no greater than the mean
0.10	0.0566	0.5199
0.20	0.1121	0.5398
0.30	0.1679	0.5596
0.40	0.2228	0.5793
0.45	0.2495	0.5890
0.50	0.2767	0.5987
0.55	0.3027	0.6083
0.60	0.3284	0.6179
0.65	0.3545	0.6274
0.70	0.3794	0.6368
0.80	0.4286	0.6554
0.90	0.4752	0.6736
1.00	0.5204	0.6915

[26] In the present example, the distribution functions can be expressed in the standardized form as:

$\Lambda(0.0066y^{1.663})$ for 1960/61,
$\Lambda(0.00043y^{2.222})$ for 1975/76.

Chart 1

INCOME DISTRIBUTION IN INDIA, 1960/61 AND 1975/76



Source: See foot-note 24.

TIME SERIES *versus* CROSS-SECTION

To use the findings from a cross-section analysis in an inter-temporal context such as projection, it is always desirable to supplement the analysis by an investigation of time series. There is no *a priori* reason, however, to expect perfect agreement between the estimators of a consumption function derived from time series and those derived from an equally competent study of cross-section data. Apparently, the cross-section and over-time variations of the same variable represent different kinds of behaviour; models for estimation are more or less simplified in any case and more or less incorrectly specified for the variables included in them; the nature of specification errors and the resulting biases should thus be different for the two approaches. To the extent that the disagreements between cross-section and time series estimates are inherent in the mechanism of statistical estimation, the propriety for predicting purposes of applying behaviour relations estimated in one context to another context is highly questionable.[27]

[27] There have been a variety of interesting discussions on this topic. See, for example, S. Valavanis, *Econometrics: An Introduction to Maximum Likelihood Methods* (New York, 1959), pages 192 to 196; E. Kuh and J. Meyer, "How Extraneous are Extraneous Estimates?", *Review of Economics and Statistics*, November 1957 (Cambridge, Mass.), pages 380 to 393; E. Kuh, "The Validity of Cross-sectionally Estimated Behavior Equations in Time-series Applications", *Econometrica*, vol. 27 (1959), pages 197 to 214, and others.

Even if we admit the danger involved in importing static inter-individual biases into a dynamic inter-temporal frame of reference, it is undeniable that somewhat heavier reliance on cross-section data than on time series for estimation purposes is in fact warranted owing to certain advantages pertaining to the former type of data. First, cross-sections typically have many more degrees of freedom than time series; the collinearity complications which frequently constitute the pitfalls of time series analyses are usually less severe in cross-section analyses; moreover, cross-sections typically allow for a much wider range of variation of the variables considered than time series and therefore are possibly more suitable for the analysis and projection of long-run variations.

In order to use cross-sectionally estimated behaviour equations for projection purposes, it is necessary only to assume that a person in any given income bracket will change his consumption pattern in the future as his income increases in the same manner as if he found himself in a correspondingly higher bracket now. In order to make this assumption empirically acceptable it may be desirable to relate more than one set of equally representative cross-section data to different points of time (with a sufficiently long time interval between them) and thus see whether time has any systematic effect upon the cross-sectional estimators. This test involves the same procedure as the one applied to stratified samples, which was discussed earlier. It should be noted in this connexion that price structure is likely to vary from one cross-section to another, and hence that the influence of price variations is likely to make significant differences between cross-section regressions for different years, at least in terms of regression positions if not slope coefficients.

The trend factor constitutes another source of difficulty for the above type of analysis. It may be more convenient to use time series data than cross-sections for a few different years, in order to test the applicability of cross-sectional estimators in the inter-temporal context. The demand function for time series typically involves the three elements:

$$c = k \cdot \nu(y) \cdot \pi(p) \cdot \tau(t),$$

where k is some constant, $\nu(y)$ the component for income effect, $\pi(p)$ for price effect and $\tau(t)$ for trend effect. The simplest form of statistical equation corresponding to the above scheme may be:

$$\log c_t = \log k + \eta \log y_t + \epsilon \log p_t + t \log (1+\lambda) + u_t,$$

where p_t may be expressed as the relative price of the expenditure item considered and λ an annual trend rate if t refers to year. Even this simple equation may not be estimated so easily because of too few degrees of freedom and intercorrelations among the independent variables.

Thus, as long as there is good reason to suspect that the direct estimates of η, ϵ and λ from time series are likely

to be too shaky to prove anything, ν (y) may as well be substituted by the outcome of the cross-section analysis; as for prices, the direct price elasticity does not cover the whole picture, but cross-elasticities (elasticities of demand for the ith item with respect to the prices of other items) are equally important; yet it is known that both direct and cross-price elasticities can be deduced, under the assumption of "want-structure independence", from the knowledge of income elasticities and budget proportions; the procedure for estimating price elasticities under this assumption will be discussed in the following section.

If both η and ε can thus be inserted from outside the time series data, the latter can be used only to isolate the trend component so that:

$$\frac{c_t}{c_0}\left(\frac{y_t}{y_0}\right)^{-\eta}\left(\frac{p_t}{p_0}\right)^{-\varepsilon}=(1+\lambda)^t,$$

where the subscript 0 indicates the beginning of the period covered by a given time series ($t = 0, 1, \ldots, T$). It would be preferable to estimate λ by least squares (assuming zero regression intercept) in order not to confuse a systematic trend with random errors.

The trend rate thus computed for each expenditure item might be considered as a demonstration of the operation of the demand equation estimated from cross-section data.[28] If λ turns out to be significant, its sign and magnitude should conform more or less with the common sense knowledge of any specific fashions of consumption during the period considered. If the magnitude of a systematic trend is too big compared with the pace of increase in consumption itself, this may be an indication that the cross-sectionally estimated demand equation (income or price elasticity) is possibly biased. In any event, a significant trend should be susceptible of reasonable explanation in the light of factual information and, for projection purposes, the self-sustainability of such a trend in the future should be carefully contemplated.

Estimation of price effects

The estimation of price effects is subject to difficulties pertinent to the treatment of time series data. The most typical case is such that the consumption of a given item, income and the price (or relative price) of the item are all increasing more or less steadily in historical time series. The estimate of price elasticity resulting from an ordinary multiple regression analysis is likely to have a wrong sign, and the price effect as such is not distinguishable from income effect due to the collinearity complication.

Another source of difficulty is the influence of supply conditions on the recorded behaviour of prices. Although prices are determined as a rule by both demand and supply, the more inelastic the supply, the more important is the supply influence. Inelastic supply conditions are a rather common phenomenon in newly developing economies, where consumption goods, especially manufactured goods, have been heavily dependent on imports, and industrialization efforts tend to enforce more or less temporary restrictive policies upon the importation of consumer goods. Under such circumstances, price cannot be regarded as a predetermined variable in a consumption function, but is itself dependent on demand conditions and thus is determined simultaneously with the amount of consumption. In other words, in a demand equation for a given item of consumption such as:

$$c=\nu(y)+\pi(p)+u,$$

the price variate p is likely to have a strong correlation with the random term u and, hence, the ordinary single equation, least squares method would result in a biased estimation. In such a case, an unbiased estimation of price effects would require the application of the simultaneous equation method, which introduces an additional equation describing the supply side of the picture, price being the dependent variable and quantity sold (and consumed) one of the independent variables.[29]

A further complication arises when one thinks of the fact that the consumption of a commodity is influenced not only by its own price, but also by the prices of many other commodities. The problem is then how to design an analysis so as to reveal the interrelationship among the demands for various categories of consumption.

Let us suppose that one is interested only in the behaviour of demand for a pair of close substitutes, commodity 1 and commodity 2. A short cut might be supplied by the empirical definition of elasticity of substitution, which may be written as:

$$E_s=\delta\log(c_1/c_2)/\delta\log(p_1/p_2),$$

where the c's denote *per capita* consumption of commodities 1 and 2 and the p's their market prices. Since the elasticity of substitution is a measure of how easily the proportion of the two commodities changes along a given community indifference curve, the statistical equation for the estimation of E_s may be such that

$$\log(c_1/c_2)=k+\theta\log(p_1/p_2)+\mu\log y$$

where the effect of income is explicitly accounted for.[30]

However, the value of $E_s = \theta$ thus estimated does not quite reveal whether the two commodities are independent of each other (cross-elasticity is zero), substitutes (cross-

[28] A good example of the trend evaluation by this method will be found in J. G. van Beeck and H. den Hartog, op. cit.

[29] Interesting examples of the application of simultaneous equation methods will be found in A. R. Bergstrom, "An Econometric Study of Supply and Demand for New Zealand's Exports", *Econometrica*, vol. 23 (1955), pages 258 to 276; Malcolm R. Fisher, "A Sector Model – The Poultry Industry of the U.S.A.", *ibid.*, vol. 26 (1958), pages 37 to 66, and so on. For empirical demonstrations in favour of recursive models (in which the parameters in each equation can be determined by considering the equations one at a time), *see*, for example, R. Pentzel and B. Hansen, "On Recursiveness and Interdependency in Economic Models", *Review of Economic Studies*, vol. XXII (1954-1955), pages 153 to 168; H. Wold and L. Jureen, *Demand Analysis* (New York, 1953), and R. Stone and G. Croft Murray, op. cit., pages 60 to 62.

[30] Irving Morrisset, "Some Recent Uses of Elasticity of Substitution – A Survey", *Econometrica*, vol. 21 (1953), pages 41 to 62; *see* also K. W. Meinken, A. S. Rojko and G. A. King, "Measurement of Substitution in Demand from Time Series Data – A Synthesis of Three Approaches", *Journal of Farm Economics*, vol. 38 (Menasha, Wis., 1956), pages 711 to 735.

elasticity is positive), or complements (cross-elasticity is negative), because the above definition of E_s involves an implicit model:

$$c_1 = f_1(p_1, p_2, y)$$
$$c_2 = f_2(p_1, p_2, y)$$

and hence

$$E_s = \frac{d \log C_1 - d \log C_2}{d \log P_1 - d \log P_2}$$
$$= \frac{E_{11} - E_{21}}{1 - \frac{d \log P_2}{d \log P_1}} + \frac{E_{22} - E_{12}}{1 - \frac{d \log P_1}{d \log P_2}}$$
$$+ \frac{E_{1y} - E_{2y}}{\frac{d \log P_1}{d \log y}\left(1 - \frac{d \log P_2}{d \log P_1}\right)}$$

where E_{11} and E_{22} stand for own price elasticities of demand for c_1 and c_2, respectively, E_{21} for cross-price elasticity of demand for C_2 with respect to P_1, E_{1y} for income elasticity of C_1, and so on.

In order to avoid this ambiguity, it would be necessary to choose a somewhat roundabout way to make the basic model explicitly in the form of structural demand equations such as,

$$c_1 = \alpha_1 P_1^{\beta_1} P_2^{\gamma_1} y^{\delta_1}$$
$$c_2 = \alpha_2 P_1^{\beta_2} P_2^{\gamma_2} y^{\delta_2}.$$

Here again, it should be noted that P_1 and P_2 cannot be treated as predetermined in each equation, but as determined simultaneously through the interaction of the demand for the two commodities, not to speak of their supply conditions. Allowing for this simultaneity, the estimation of the parameters in the above structural equation will have to rely on the reduced-form method of fitting simultaneous equations, that is, expressing each of the jointly determined variables P_1 and P_2 separately as a function of all the other variables. The reduced-form equations then become:

$$\log P_1 = \log b_{01} + b_{11} \log c_1 + b_{21} \log c_2 + b_{31} \log y$$
$$\log P_2 = \log b_{02} + b_{12} \log c_1 + b_{22} \log c_2 + b_{32} \log y,$$

each of which can be fitted on the available time series data by the ordinary least squares method.[31]

It has so far been assumed that the influence of other commodities is negligible. When one is interested in obtaining a more generalized picture of cross-elasticities for a number of commodities, the application of the above scheme of analysis to each pair of commodities would require an enormously time-consuming amount of work and the validity of the estimation results might often be questionable.[32]

Although it is difficult in practice to obtain information about cross price elasticities by handling time series data, the indirect estimation method devised by Ragnar Frisch may be very useful for a general analysis of interrelationships among demands for a number of commodities. Frisch's derivation of the formulas is part of a more general exposition of his demand theory.[33] This is not the place to restate his theorems at length. The key point is that it is possible under certain assumptions to calculate the direct price and cross price elasticities for all expenditure categories simultaneously if the expenditure elasticities (Engel elasticities) and the budget proportions of all expenditure categories are known (and if at least one direct price elasticity is known). That is, when the demand functions are conceived in the following general form:

$$c_i = c_i(P_1, P_2, \ldots, P_n, E), \quad (i = 1, \ldots, n),$$

where c_i denotes physical quantity of the ith category of consumption and E total expenditure, so that

$$E = P_1 c_1 + P_2 c_2 + \ldots + P_n c_n,$$

then price elasticities can be expressed, assuming that expenditure category k is "want-independent" of all other categories, as:

Direct price elasticity: $\epsilon_{kk} = -\eta_k\left(\pi_k - \frac{1 - \pi_k \eta_k}{\breve{\omega}}\right)$

Cross price elasticity: $\epsilon_{ik} = -\pi_k \eta_i \left(\frac{1 + E_{kk}}{1 - \pi_k \eta_k}\right), \quad (i \neq k)$

in which η stands for the Engel elasticity:

$$\eta = \frac{\delta c_i}{\delta E} \frac{E}{c_i}$$

π, budget proportion:

$$\pi = P_i c_i / E,$$

and $\breve{\omega}$ "money flexibility" — elasticity of marginal utility of money ω with respect to E:

$$\breve{\omega} = \frac{\delta \omega}{\delta E} \cdot \frac{E}{\omega} \quad \text{(all } P\text{'s being constant)}.$$

The numerical value of the money flexibility $\breve{\omega}$ is not known as such, but it can be derived from the knowledge of direct price elasticity. Engel elasticity and budget proportion of any one representative expenditure category j:

$$\breve{\omega} = \frac{\eta_j (1 - \pi_j \eta_j)}{\epsilon_{jj} + \pi_j \eta_j}.$$

Leif Johansen gave support to this hypothesis by using

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[31] From these estimates, the parameters in the structural demand equations are to be obtained as:

$$\beta_1 = b_{22}/\lambda; \ \beta_2 = -b_{12}\ \lambda; \ \gamma_1 = -b_{21}\ \lambda; \ \gamma_2 = b_{11}\ \lambda$$
$$\delta_1 = (b_{21} b_{32} - b_{31} b_{22})\ \lambda; \ \delta_2 = (b_{12} b_{31} - b_{32} b_{11})\ \lambda$$

where

$$\lambda = b_{11} b_{22} - b_{21} b_{12}.$$

[32] For example, K. W. Meinken and others, op. cit., applied the structural demand equations to the Canadian time series data for beef and pork. The resulting estimates of cross elasticities for these two commodities were not statistically significantly different from zero. However, the short cut estimation gave a value of substitution elasticity θ close to -1. The implication of this concept is rather ambiguous as regards the nature of the demand interrelationship, as mentioned above.

[33] R. Frisch, "A Complete Scheme for Computing All Direct and Cross Demand Elasticities in a Model with Many Sectors", *Econometrica*, vol. 27 (1957), pages 177 to 196.

Norwegian data for a few groups of commodities.[34]

	Budget proportion π_i	*Engel elasticity* η_i	*Direct price elasticity* ϵ_i	*Money flexibility* $\check{\omega}$
Agricultural products	0.0900	0.6978	−0.4	−1.94
Manufactured food and beverages	0.2485	0.7996	−0.5	−2.13
Land and air transport	0.0356	2.0451	−1.1	−1.85

The alternative estimates of appeared to be in close agreement with one another, and so a combined value of 1.89 for $\check{\omega}$ was used to compute the whole matrix ϵ_{ik} ($i = 1, \ldots, n$; $k = 1, \ldots, n$). Table 5 shows the matrix of price elasticities thus computed: they are related to producers' prices, and are based on the budget proportions derived from the input-output data for the year 1950 of the Norwegian Central Bureau of Statistics. Johansen's matrix is given in terms of derivatives ($\delta c_i / \delta P_j$) instead of elasticities and is already adjusted for producers' prices in accordance with input-output concepts. Conversion of his matrix into the form of table 5 was done by using his data for budget proportions (in terms of producers' prices).[35] The elasticities relating to purchasers' prices are higher than those relating to producers' prices as long as trade margins are positive. This reflects the fact that an increase of one per cent in purchasers' price, with a constant absolute trade margin (the price of trade services being constant) implies an increase in producers' prices of more than one per cent, provided that the trade margin is positive.

The Engel elasticities are not affected by the difference in pricing methods; their estimates (*see* the last line of table 5) are thus applicable to both producers' and purchasers' prices. But the expenditure elasticity of trade services (sector 14) is newly added in the system with producers' prices; this was calculated as:

$$\eta_{14} = \frac{E \sum_i^n m_i (\delta c_i / \delta E)}{\sum_i^n m_i c_i}, \qquad (i = 1, \ldots, 13)$$

where m_i represents the trade margin as a proportion of purchasers' prices.

Apart from this particular example for the Norwegian economy, Frisch suggests the possibility of constructing a universal "atlas" of the values of money flexibility, which would vary among different types of populations and among different countries. If such an atlas were available, there would be no need for independent information about any direct price elasticity. Frisch thus suggests[36] that in most cases the money flexibility has values of the following order of magnitude:

$\check{\omega} = -10$: for an extremely poor and apathetic type of consumer;
$\check{\omega} = -4$: for the slightly better-off but still poor household with a fairly pronounced desire to become better off;
$\check{\omega} = -2$: for the middle income bracket;
$\check{\omega} = -0.7$: for the better-off part of the population;
$\check{\omega} = -0.1$: for the richest part of the population with a strong desire for conspicuous consumption.

This implies that the poorer and the more apathetic is the consumer, the smaller is the absolute value of direct price elasticity, other things being equal, and the more strongly is his consumption influenced by changes in his money income. Apparently, the opposite seems to be true for cross price elasticity: the lower the money flexibility (or the poorer the consumer), the stronger the effect of a change in the price of the kth category upon the consumption of the ith category; but this effect is also heavily dependent on the relative importance of the kth category (and not the ith category) in total expenditure, and on that score the influence of P_k on c_i works rather as the influence of the change in real income caused by the change in P_k.

It should be noted in this connexion that in the demand equation of Frisch,

$$c_i = k_i \cdot E^{\eta_i} P_i^{\epsilon_{ii}} \prod_{j \neq i} P_j^{\epsilon_{ij}},$$

the Engel elasticity coefficient η is related to total expenditure in *current* prices and not in constant prices. The cross price elasticities in his context are therefore not concerned with the movement along the same indifference curve, unlike the case when similar terms were referred to in the discussion of substitution elasticity a while ago. However, the above demand equation can easily be converted into the form:

$$c_i = k_i c^{\eta_i} P_i^{\epsilon_{ii} + \pi_i \eta_i} \prod_{j \neq i} P_j^{\epsilon_{ij} + \pi_j \eta_i},$$

where c is total consumption expenditure deflated by an index of the cost of living, and the latter is defined as the weighted geometric average of P_i's (for $i = 1, \ldots, n$):

$$Q = \Pi_i P_i^{\pi_i}$$

in which π's denote the budget proportions. The expenditure elasticities remain the same as before, but the price elasticities of each expenditure category are to be lowered in their absolute values to the extent that the effect of changes in real income due to price changes is readily represented by the expenditure elasticity η_i.

Unless one is interested in the interrelationships among the demands for many expenditure categories, all the cross price elasticities may as well be omitted in the demand equation. If this simplification is preferred, the price of each expenditure category had better be expressed in terms of *relative* price, that is, P_i/Q. Then, the elasticity

[34] Leif Johansen, *A Multi-Sectoral Study of Economic Growth* (Amsterdam, 1960), table 6.4.1;1, page 107. For this test, it has to be assumed that the estimates of direct price elasticities are reliable as such. For non-metallic mineral products, Johansen obtained an estimate of $\check{\omega}$ very different from the above three, but the estimate of direct price elasticity of this category was believed to be considerably biased.

[35] *Ibid.*, table 6.3.1;3, page 100. The difference between purchasers' and producers' prices in his scheme relates only to trade margins and does not include transportation costs.

[36] R. Frisch, op. cit., page 189.

Table 5

MATRIX OF DIRECT PRICE AND CROSS PRICE ELASTICITIES BASED ON PRODUCER PRICE DATA FOR NORWAY

Sectors for expenditures i	*Sectors for P_j*[a] 0	1	2	3	4	5	6	7	8	9
0. Non-competitive imports	−0.314	−0.029	−0.015	−0.034	−0.023	−0.027	−0.022	−0.002	−0.017	−0.024
1. Agriculture	−0.035	−0.354	−0.018	−0.039	−0.027	−0.031	−0.025	−0.002	−0.020	−0.028
2. Forestry and hunting	−0.007	−0.007	−0.701	−0.008	−0.005	−0.007	−0.005	−0.001	−0.004	−0.006
3. Fishing	−0.001	−0.001	−0.001	−0.092	−0.001	−0.001	−0.001	−0.000	−0.001	−0.001
4. Mining	−0.002	−0.002	−0.001	−0.002	−0.412	−0.002	−0.001	−0.000	−0.001	−0.002
5. Food, beverage and tobacco	−0.104	−0.102	−0.043	−0.117	−0.080	−0.438	−0.076	−0.007	−0.059	−0.083
6. Textiles, clothing, leather and rubber products	−0.087	−0.086	−0.045	−0.097	−0.066	−0.078	−0.456	−0.006	−0.049	−0.069
7. Wood products, pulp and paper products	−0.025	−0.025	−0.013	−0.028	−0.019	−0.023	−0.018	−0.657	−0.014	−0.020
8. Printing and publishing and other manufacturing	−0.023	−0.023	−0.012	−0.026	−0.018	−0.021	−0.017	−0.002	−0.476	−0.018
9. Chemical products	−0.004	−0.004	−0.002	−0.005	−0.003	−0.004	−0.003	−0.000	−0.002	−0.265
10. Non-metallic mineral products	−0.005	−0.005	−0.002	−0.005	−0.004	−0.004	−0.004	−0.000	−0.003	−0.004
11. Basic metals	—	—	—	—	—	—	—	—	—	—
12. Metal products	−0.028	−0.028	−0.015	−0.032	−0.022	−0.025	−0.021	−0.002	−0.016	−0.022
13. Electricity, gas and water	−0.012	−0.012	−0.006	−0.013	−0.009	−0.011	−0.009	−0.001	−0.007	−0.009
14. Trade	−0.184	−0.155	−0.026	−0.310	−0.182	−0.174	−0.218	−0.310	−0.234	−0.313
15. Building	−0.030	−0.030	−0.016	−0.034	−0.023	−0.027	−0.022	−0.002	−0.017	−0.024
16. Water transport	−0.010	−0.009	−0.005	−0.011	−0.007	−0.009	−0.007	−0.001	−0.005	−0.008
17. Land and air transport	−0.046	−0.046	−0.024	−0.052	−0.036	−0.042	−0.034	−0.003	−0.026	−0.037
18. Communication	−0.002	−0.002	−0.001	−0.002	−0.002	−0.002	−0.001	−0.000	−0.001	−0.002
19. Services	−0.082	−0.081	−0.043	−0.093	−0.063	−0.074	−0.060	−0.005	−0.047	−0.066
Budget proportions (1950)	0.071	0.078	0.009	0.003	0.003	0.203	0.134	0.022	0.030	0.007
Engel elasticities (η_i)	0.685	0.698	1.265	0.532	0.966	0.800	1.008	1.815	1.206	0.928

Sectors for expenditures i	*Sectors for P_j*[a] 10	11	12	13	14	15	16	17	18	19
0. Non-competitive imports	−0.009	—[b]	−0.012	−0.029	−0.053	−0.025	0.008	0.004	−0.032	−0.017
1. Agriculture	−0.010	—	−0.014	−0.034	−0.049	−0.029	0.010	0.004	−0.038	−0.020
2. Forestry and hunting	−0.002	—	−0.003	−0.007	−0.004	−0.006	0.002	0.001	−0.008	−0.004
3. Fishing	−0.000	—	−0.000	−0.001	−0.004	−0.001	0.000	0.000	−0.001	−0.001
4. Mining	−0.001	—	−0.001	−0.002	−0.003	−0.002	0.001	0.000	−0.002	−0.001
5. Food, beverage and tobacco	−0.031	—	−0.042	−0.100	−0.170	−0.086	0.029	0.013	−0.112	−0.061
6. Textiles, clothing, leather and rubber products	−0.026	—	−0.035	−0.084	−0.175	−0.072	0.024	0.011	−0.093	−0.051
7. Wood products, pulp and paper products	−0.007	—	−0.010	−0.024	−0.057	−0.021	0.007	0.003	−0.027	−0.015
8. Printing and publishing and other manufacturing	−0.007	—	−0.009	−0.022	−0.048	−0.019	0.006	0.003	−0.025	−0.013
9. Chemical products	−0.001	—	−0.002	−0.004	−0.013	−0.004	0.001	0.001	−0.005	−0.003

Table 5 (continued)

Sectors for expenditures i	*Sectors for* P_j[a]									
	10	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*
10. Non-metallic mineral products	−0.523	—	−0.002	−0.005	−0.012	−0.004	0.001	0.001	−0.005	−0.003
11. Basic metals	—	—	—	—	—	—	—	—	—	—
12. Metal products	−0.008	—	−0.558	−0.027	−0.056	−0.023	0.008	0.003	−0.030	−0.016
13. Electricity, gas and water	−0.004	—	−0.005	−0.379	−0.011	−0.010	0.003	0.001	−0.013	−0.007
14. Trade	−0.318	—	−0.236	−0.117	−0.214	−0.088	0.030	0.013	−0.115	0.062
15. Building	−0.009	—	−0.012	−0.029	−0.023	−0.495	0.008	0.004	0.032	0.017
16. Water transport	−0.003	—	−0.004	−0.009	−0.007	−0.008	−1.176	0.001	−0.010	0.006
17. Land and air transport	−0.014	—	−0.019	−0.045	−0.036	−0.039	0.013	−1.073	−0.050	0.027
18. Communication	−0.001	—	−0.001	−0.002	−0.002	−0.002	0.001	0.000	−0.312	0.001
19. Services	−0.025	—	−0.034	−0.080	−0.063	−0.068	0.023	0.010	−0.089	0.675
Budget proportions (1950)	0.005	—	0.031	0.025	0.173	0.052	0.007	0.036	0.005	0.108
Engel elasticities (η_i)	1.530	—	1.401	0.723	0.970	0.892	2.233	2.045	0.587	1.188

Source: Computed from Leif Johansen, *A Multi-Sectoral Study of Economic Growth*, chapter 6.
[a] The numbers on top of the columns correspond to the items in the stub.
[b] Not applicable.

with respect to own *relative* price ($\hat{\epsilon}_{ii}$) is not the same as that with respect to own absolute price (ϵ_{ii}), but can be approximated, under certain simplifying assumptions,[7] by:

$$\hat{\epsilon}_{ii} = (\epsilon_{ii} + \pi_i \eta_i) : (1 - \pi_i).$$

[7] These assumptions are (i) that all other P_j prices ($j \neq i$) are expected to change equally in the same direction, and (ii) that there is no money illusion in the sense that consumers are fully aware of price changes and react rationally to them. This method was suggested by J. G. van Beeck and H. den Hartog, op. cit.

INTERNATIONAL REFERENCE PATTERNS

Purpose of cross-country analysis and the basic hypothesis about tastes

The data obtainable in an under-developed country are generally of vulnerable quality; time series are too short or discontinuous and surveys are too partial or incomplete to allow for any decent analytical treatment. Moreover, a demand pattern estimated from past data, time series or cross-sections, is not susceptible of extrapolation to the future as it is, since the basic economic and social structure of such a country is not to remain stable but is subject to radical changes in the future, unlike the case of advanced countries. Under such circumstances, information about consumption patterns in other countries are indispensable to evaluate future prospects.

Apart from the experiences in individual countries, there has been a markedly rising tendency in the effort to investigate the future prospects of demand and supply conditions of various commodities in connexion with the work programme of the United Nations family and related various study groups. The terms of reference in which these studies are prepared concern certain major commodities, both agricultural and non-agricultural, that enter international trade and therefore are vital for the prospects of export possibilities and import requirements in the less developed areas of the world, in particular. Most of these studies are primarily related to the global perspectives by regions or sub-regions, leaving their incidence on individual countries to secondary considerations. Very roughly, three types of approaches can be distinguished: (*a*) analysis of time series of global aggregates; (*b*) cross-section analysis relating to the observations for a number of countries either at a given point of time or during a given time period; and (*c*) co-variance analysis applied to the observations for a number of countries at a number of time points. From the standpoint of an individual country, the last two types might have a more or less direct use to the extent that such analyses were successful enough to provide a knowledge about the behaviour of a "normal" or "reference" country, so to speak, defined in terms of behaviour relationships in very few economic variables. The characteristics of such global-prospect studies relating to producer goods in particular will be discussed later. For the moment, however, discussions will concentrate on consumer demand.

For the purpose of international comparison of consumption patterns, it is not necessary to assume complete uniformity of tastes, but there has to be some degree of similarity, for otherwise all observed variations in consumption patterns could be imputed to variations in

tastes, even though they are at the same time consistent with Engel's law to a substantial extent. On this score, the argument put forward by H. S. Houthakker may be used to provide evidence in favour of the international similarity of tastes, though it is suggestive rather than conclusive.[38] Namely, if prices in two countries A and B are different, there is some scope for substitution between commodities: a consumer who is free to adjust himself to prices in either country without changing his tastes and real income will tend to buy more of the goods that are cheaper in each country; hence for this consumer, when his consumption activity takes place in country B, prices will be lower if weighted by his consumption pattern in that country than if weighted by the pattern he would have in country A: in other words, taking country A as the base, the Paasche price index number appears lower than the Laspeyres price index number:

$$I^* = \Sigma P^B Q^B : \Sigma P^A Q^B < I = \Sigma P^B Q^A : \Sigma P^A Q^A.$$

This implies in terms of purchasing power parities that the purchasing power of B's currency (expressed in A's currency) tends to be greater when B's own consumption pattern is used as weights ($1/I^*$). Thus, by considering $1/I^* > 1/I$ as the normal case, it can be used as a first test of similarity of tastes. Furthermore, it can be argued that even the abnormal case $I^* \geqslant I$ does not necessarily contradict the consistency conditions of the "revealed preference" theory, since the latter is contradicted only when the corresponding Paasche and Laspeyres quantity index numbers are such that

$$I < 1 < I^*,$$

where

$$I = \Sigma P^A Q^B : \Sigma P^A Q^A$$
$$\text{and } I^* = \Sigma P^B Q^B : \Sigma P^B Q^A.$$

The result of the tests, using the existing data for I, I^*, J and J^* for various countries proved to be quite favourable for the similarity of tastes. The revealed preference axiom is not a rigorous proof of the hypothesis but does succeed at least in lessening the suspicion of international dissimilarity of tastes.[39]

Cross-section analysis of international data

With the question of tastes at least temporarily out of the way, there still remain many problems to be solved as one proceeds to the actual work of statistical analysis with the aim of establishing international reference patterns of consumption expenditures. The very first requirement is that basic data be adjusted for international price differences by means of some suitable purchasing power parities prepared for various categories of consumption separately. The discussions in the preceding section imply that the observed variations of quantities and prices among countries depend to some extent on the weighting system used. The choice of weighting system is thus a serious matter especially for large aggregates such as income, total consumption and major categories of consumption. It remains to be seen first whether the differential influences of different weighting systems are not too strong to maintain some stability in the concept of reference patterns.

The experiments made by Gilbert and associates may be referred to in this connexion. In applying the log-linear demand equations of the form:

$$\log Q_i = \log A_i + a_i \log Q + b_i \log (P_i/P)$$

where Q_i stands for the index number of *per capita* consumption by individual category, taking the United States of America as the base; Q the index number of total *per capita* consumption; P_i the purchasing power equivalent of the ith category of consumption; P that of total consumption, and A_i regression constant, the different weighting systems were used for testing purposes:

Weighting system	*Prices used to weight quantity ratios*	*Quantities used to weight price ratios*
A	European	United States
B	United States	European
C	European	European
D	United States	United States

By European is meant that the index numbers of a country are constructed by weighting the data for both that country and the United States of America by that country's own price or quantity structure. The countries considered are the eight European countries mentioned before (Belgium, Denmark, Federal Republic of Germany, France, Italy, Netherlands, Norway and United Kingdom) and Q_i's refer to six major categories (food, alcoholic beverages, tobacco, clothing and household textiles, housing, and fuel, light and water). The resulting estimates of elasticity coefficients appear to be rather

[38] *See* H. S. Houthakker, op. cit.

[39] For a binary comparison of eight European countries with the United States, *see* Milton Gilbert and Irving B. Kravis, op. cit., tables 27 to 30, pages 113 to 119, and M. Gilbert and associates, op. cit., tables 38 to 41, pages 99 to 106. A binary comparison of some twenty countries with the Federal Republic of Germany is available in Statistisches Bundesamt, *Preise Löhne Wirtschaftsrechnungen, Internationaler Vergleich der Preise für die Lebenshaltung* (Wiesbaden, 1960, 1961 and 1962). For the seven countries in the European Coal and Steel Community, binary parities are computed for every possible pair of countries in Office statistique des Communautés européennes, *Prix, taux d'équivalence de pouvoir d'achat à la consommation et revenus réels dans les pays de la CECA, 1954-1958* (Luxembourg, 1960). It is unfortunate that the recent study of the Economic Commission for Latin America (ECLA) on the purchasing power parities for the twenty Latin American countries did not carry out any binary comparison: *see* United Nations, "A Measurement of Price Levels and the Purchasing Power of Currencies in Latin America 1960-1962" (mimeographed document E/CN.12/653). The basic data prepared for this ECLA study are, however, now being reprocessed for the purpose of complete binary comparisons at the computation center of Yale University under the direction of Professor Richard Ruggles and Mrs. Nancy Ruggles; the preliminary results which have so far been made available to the author appear to be largely favourable for the similarity of tastes among the countries considered.

sensitive to the choice of weights, although multiple-correlation coefficients are almost unaffected.[40] The pattern of variation in the consumption (Engel) elasticities is somewhat consistent: they are generally lowest with system *C* and highest with system *D*, those with systems *A* and *B* falling in the middle of the range. An extreme example obtains for clothing and household textiles for which the estimates of consumption elasticities are: 0.84 (± 0.14) with *A*, 0.60 (± 0.39) with *B*, 0.38 (± 0.28) with *C* and 1.19 (± 0.22) with *D*. As regards price elasticities, however, there seems to be no consistent pattern of variation; again for clothing and household textiles they are: −0.77 (± 0.54) with *A*, −1.19 (± 0.61) with *B*, −1.33 (± 0.63) with *C* and −0.61 (± 0.61) with *D*. The standard errors of these coefficients are quite high in some cases, implying significant degrees of intercorrelation between total consumption levels and relative prices. But it is not clear whether the degree of intercorrelation varies in any systematic way from one weighting system to another.

Generally speaking, the greater the disparity between the income levels of two countries, the greater the extent to which the price and quantity structures differ between the countries, and hence the more serious the implications of the choice of weights for inter-country comparisons. Yet there does not seem to exist a well-established theoretical criterion by which an optimal weighting basis can be determined in an *a priori* manner; the use of a different weighting system gives a slightly different concept of the demand curve, but "the values of the income and price elasticities pertaining to each concept are all perfectly valid measures of the elasticities corresponding to the particular concepts concerned".[41] It appears, however, that the results obtained by using either system *A* or *B* (the mixed weights) are likely to be more comparable with other elasticity measurements. The complete set of demand equations estimated by Gilbert and associates on the basis of system *A* are reproduced in table 6.

The weakest point of Gilbert and associates' estimates is the smallness of the sample and its limitations to the countries of the Organisation for European Economic Cooperation (OEEC). For that matter there may be some advantage in using the data of the Statistical Office of the Federal Republic of Germany in that they cover as many as forty-nine countries in various geographical

[40] *See* Gilbert and associates, op. cit., page 159.

[41] *Ibid.*, page 161.

Table 6

CROSS-COUNTRY ESTIMATES OF CONSUMPTION AND PRICE ELASTICITIES BY M. GILBERT AND ASSOCIATES AND BY T. WATANABE

Category of consumption	*Gilbert's estimates*		*Watanabe's estimates*	
	Consumption elasticity	*Price elasticity*	*Consumption elasticity*	*Price elasticity*
Food	0.54 (0.05)	−0.27 (0.27)		
Alcoholic beverages	0.77 (0.49)	−0.98 (0.45)	0.744 (0.035)	[a]
Tobacco	0.88 (0.28)	−0.26 (0.29)		
Clothing and footwear	0.84 (0.14)	−0.77 (0.54)	1.159 (0.168)	−0.516 (0.330)
Footwear	1.01 (0.09)	−0.62 (0.20)		
Clothing and household textiles	0.84 (0.15)	−0.63 (0.61)		
Housing (rent)	0.81 (0.11)	[a]	1.040 (0.173)	[a]
Fuel, light and water	1.19 (0.32)	−0.86 (0.40)	1.117 (0.164)	−0.463 (0.234)
Furniture and household equipment	2.10 (0.34)	[a]	1.780 (0.096)	[a]
Household and personal services	1.19 (0.21)	−1.35 (0.53)		
Transportation	1.76 (0.20)	[a]		
Purchase of transportation equipment	0.71 (0.78)	−3.84 (1.66)		
Operation of transportation equipment	2.28 (0.33)	[a]	1.355 (0.103)	[a]
Public transportation services	1.10 (0.17)	−1.79 (0.39)		
Communication	2.03 (0.20)	−0.92 (0.31)		
Recreation	1.15 (0.23)	−0.99 (0.50)		
Health	1.80 (0.33)	−1.59 (0.80)		
Education	0.75 (0.13)	−0.99 (0.22)		

Source: As given in the text.

[a] Multiple regressions produced positive coefficients for price elasticities and therefore the price variable was omitted from the demand equations.

regions, for some of which more than one date is covered. It is regrettable, however, that the expenditure data comparable to the computed parities are not disclosed; moreover, for about one-half of the countries, especially for newly developing countries, observations are limited to cities and therefore not representative of the behaviour of each nation as a whole. With all these difficulties, an attempt has been made by T. Watanabe to estimate consumption elasticities by applying the German weight parities to the national consumption data in United Nations, *Yearbook of National Accounts Statistics*.[42] The sample includes twenty-two countries in all.[43] The same form of demand functions is employed as that used by Gilbert, but the observations of quantity and price variables are all based on the German weights. The weighting method thus corresponds to Gilbert's system *D*. The resulting Watanabe's estimates of elasticities appear alongside of Gilbert's estimates in table 6. It should be noted that the generally poor consistency of classification in the United Nations data makes it necessary to limit the cross-country analysis to aggregative categories of consumption such as those by Watanabe. "Food" includes beverages and tobacco, and transportation, communications and other services are lumped together as "all others". Aside from this classification difficulty, the two estimates are rather comparable with each other, considering the fact that Gilbert's estimates in table 6 are based on weighting system *A* and that they would become somewhat higher if they were based on system *D*. The behaviour of the price variates is rather discouraging in both cases. In the case of Watanabe's estimates the possible inconsistencies of classification between the United Nations and German data may sometimes have overshadowed the price effects which would have proved significant otherwise.

Cross-country comparison of time series estimates

Needless to say, the validity as reference of the behaviour relations estimated from the cross-sectional comparison of countries remains dubious unless it is evidenced that individual countries behave in time, at least on the average, in accordance with the cross-sectionally estimated patterns. Since the pragmatic value of a reference pattern stems *inter alia* from the paucity of relevant data in newly developing countries, the basic information from which such a pattern is derived should include as often as possible the observations available for developing countries. Table 7 thus presents the results of an analysis of annual series (at constant prices) of private consumption expenditures for thirteen countries. The data are obtained from United Nations *Yearbook of National Accounts Statistics* as in the case of Watanabe's analysis, but the exchange rate problem does not arise in the context of the analysis of within-country variations. Out of the twelve categories of consumption in the United Nations data, only four are selected: clothing and other personal effects, furniture, furnishings and household equipment, beverages and tobacco (the latter two being combined in one category); for at this level of aggregation these are among the categories most typically composed of manufactured goods.

The fitted equations are all of the double-logarithmic form, but two alternative independent variables are used to check the possibility of estimation biases due to the factor mentioned before.

$$(a)\ \log C_i = \alpha_i + \beta_i \log y + u_i,$$
$$(b)\ \log C_i = \alpha'_i + \beta'_i \log C + u'_i,$$

where C_i designates *per capita* consumption expenditure on the ith category; C total *per capita* consumption, which is the sum of categories 1 to 12 in the United Nations table of "Composition of private consumption expenditure", and y *per capita* disposable income obtained as income minus direct taxes from the United Nations table of "Receipts and expenditures of households and private non-profit institutions" and deflated by the implicit price deflators for total consumption. Since y can be used as the instrumental variable, an additional regression is made for each country to correlate C with y, that is,

$$(c)\ \log C = a + b \log y + u.$$

The ratio of the least squares estimates $\hat{\beta}$, $\hat{b}$ gives the Engel coefficient which is supposedly free from the bias involved in the direct estimator $\hat{\beta}'_i$ owing to the correlation between C and u_i in equation (b). In fact, however, by comparing such ratios $\hat{\beta}_i$, $\hat{b}$ against $\hat{\beta}'_i$ in table 7, one would find that this particular source of estimation bias is generally not too important, the value of $\hat{\beta}_i$, $\hat{b}$ falling in almost all cases within the range of $\hat{\beta}'_i \pm$ one standard error $(S_{\beta'_i})$; moreover, there appears to be no systematic pattern in the directions of such biases as among different categories of consumption or among countries.

In any case, the regression coefficients estimated from individual countries' time series may vary to a considerable extent from one country to another. Their values do in some cases diverge tremendously from those usually expected on the basis of consumer budget studies in individual countries and of the cross-country studies referred to in the preceding section. And the suspicion may be reinforced that the basic model is too simplified and too poorly specified for the derivation of meaningful elasticity coefficients. However, before any general assertion is made, it is necessary to see whether there are any statistically acceptable average patterns involved behind the apparent differences; that is, whether the differences of regression among countries are statistically significant or not.

A test of parallelism to the one applied to stratified cross-section samples may be employed for this purpose. Table 8 gives the results of the test together with the

[42] Tsunehiko Watanabe, "A Note on an International Comparison of Private Consumption Expenditure", *Weltwirtschaftliches Archiv*, vol. 88, No. 1 (Hamburg, 1962), pages 145 to 149.

[43] Argentina, Australia, Austria, Belgium, Canada, Chile, Colombia, Denmark, Federal Republic of Germany, France, Israel, Italy, Japan, Luxembourg, Netherlands, Norway, Peru, Portugal, Sweden, United Kingdom, United States of America, and Yugoslavia.

Table 7

TIME SERIES REGRESSIONS: THIRTEEN COUNTRIES

(*a*) $\log C_i = \alpha_i + \beta_i \log y$

(*b*) $\log C_i = \alpha'_i + \beta'_i \log C$

Item	*Ecuador (1952-1961)*	*Greece (1954-1961)*	*Honduras (1952-1960)*	*Ireland (1954-1961)*	*Israel (1955-1961)*	*Italy (1952-1961)*	*Korea (Republic of) (1955-1961)*	*Malta (1954-1961)*	*Nigeria (1951-1957)*	*Peru (1952-1959)*	*Puerto Rico (1954-1961)*	*Rhodesia and Nyasaland Federation of (1954-1961)*	*South Africa (Republic of) (1953-1959)*
Clothing and other personal effects													
(*a*) $\hat{\beta}$	[a]	0.954	2.778	0.871	0.590	0.498	1.671	0.394	2.663	4.250	0.968	0.862	1.403
$(S_{\hat{\beta}})$		(0.084)	(1.063)	(0.369)	(0.151)	(0.074)	(0.560)	(0.146)	(0.397)	(1.975)	(0.056)	(0.212)	(0.207)
R^2		0.955	0.493	0.702	0.754	0.851	0.561	0.545	0.900	0.480	0.980	0.732	0.902
(*b*) $\hat{\beta}'$	[a]	1.129	2.769	0.915	0.820	0.710	1.477	0.501	0.872	2.459	1.050	1.828	1.814
$(S_{\hat{\beta}'})$		(0.104)	(0.322)	(0.203)	(0.127)	(0.100)	(0.132)	(0.152)	(0.566)	(1.121)	(0.042)	(0.451)	(0.148)
R^2		0.954	0.913	0.893	0.957	0.863	0.945	0.673	0.322	0.490	0.920	0.732	0.968
Furniture, furnishings and household equipment													
(*a*) $\hat{\beta}$	[a]	1.377	[a]	2.493	1.752	1.965	[a]	2.860	5.398	1.850	1.679	[a]	1.267
$(S_{\hat{\beta}})$		(0.104)		(0.522)	(0.166)	(0.104)		(0.401)	(1.018)	(0.971)	(0.202)		(0.268)
R^2		0.969		0.957	0.656	0.978		0.894	0.850	0.421	0.933		0.816
(*b*) $\hat{\beta}'$	[a]	1.645	[a]	2.682	2.198	2.790	[a]	3.274	2.612	1.530	1.835	[a]	1.667
$(S_{\hat{\beta}'})$		(0.082)		(0.339)	(0.279)	(0.143)		(0.455)	(0.830)	(0.256)	(0.180)		(0.240)
R^2		0.985		0.925	0.893	0.906		0.896	0.664	0.878	0.990		0.906
Beverages and tobacco													
(*a*) $\hat{\beta}$	3.442	0.430	1.542	0.526	0.467	0.540	0.643	1.338	0.963	[a]	0.766	1.604	[a]
$(S_{\hat{\beta}})$	(0.508)	(0.060)	(1.250)	(0.168)	(0.151)	(0.067)	(0.267)	(0.378)	(0.144)		(0.084)	(0.362)	
R^2	0.851	0.897	0.177	0.656	0.925	0.979	0.453	0.676	0.900		0.944	0.765	
(*b*) $\hat{\beta}'$	2.730	0.519	2.187	0.516	0.554	0.770	0.547	1.479	0.543	[a]	0.810	3.254	[a]
$(S_{\hat{\beta}'})$	(0.322)	(0.062)	(0.587)	(0.174)	(0.217)	(0.088)	(0.124)	(0.461)	(0.054)		(0.113)	(0.871)	
R^2	0.900	0.921	0.664	0.566	0.566	0.905	0.736	0.632	0.953		0.896	0.961	
Regressions of log C upon log y:													
Regression coefficient	1.260	0.835	1.055	0.955	0.764	0.703	1.302	0.847	1.550	1.250	0.922	0.396	0.770
(Standard error)	(0.108)	(0.050)	(0.327)	(0.117)	(0.024)	(0.024)	(0.282)	(0.088)	(0.433)	(0.545)	(0.039)	(0.103)	(0.094)
R^2	0.994	0.979	0.597	0.917	0.951	0.991	0.753	0.938	0.720	0.512	0.989	0.713	0.923

Source: United Nations, *Yearbook of National Accounts Statistics* for the years 1958, 1959, 1960 and 1961.

[a] Regression fits are extremely poor, R^2 being not significantly different from zero.

Table 8

COMBINED TIME SERIES REGRESSIONS AND PARALLELISM TESTS

Item	Combined regressions			Sum of squares				
	Regression coefficients	Standard error	R^2	Difference of regressions	Degrees of freedom	Combined residuals	Degrees of freedom	F[a]
Clothing and other personal effects								
(*a*)	0.795	(0.089)	0.526	0.03514	11	0.04390	72	5.23
(*b*)	1.007	(0.086)	0.676	0.01770	11	0.03939	72	2.93
Furniture, furnishings and household equipment								
(*a*)	1.982	(0.129)	0.820	0.05836	8	0.05087	52	7.43
(*b*)	2.369	(0.138)	0.850	0.02593	8	0.06479	52	2.60
Beverages and tobacco								
(*a*)	0.709	(0.080)	0.527	0.02726	10	0.03495	70	5.45
(*b*)	0.817	(0.089)	0.548	0.02883	10	0.03051	70	6.55
Regression of log *C* upon *y*								
(*c*)	0.825	(0.037)	0.859	0.00494	12	0.01071	80	3.25

Source: Based on the data in table 7.

[a] For example, with the degrees of freedom of 10 (for greater mean square) and 70 (for lesser mean square), the difference of regressions is statistically insignificant if $F<2.59$ at the 99 per cent confidence level and if $F<1.97$ at the 95 per cent confidence level.

average (combined) elasticity coefficients computed; all the differences of regressions are assumed to be insignificant. The *F* ratios are generally high enough to reject the assumption at the confidence level no lower than 99 per cent.[44] This is not too surprising in view of the fact that the analysis is based on a rather hastily built model, without explicitly taking into account the price and other time effects from which the true income effects should be abstracted. But it is encouraging, with all these qualifications, that the average coefficients turn out to be of an order of magnitude comparable to that often obtained from other elasticity measurements (for example, Gilbert's and Watanabe's).

OVER-TIME COMPARISON OF CROSS-COUNTRY ESTIMATES

The discussions have so far been limited to somewhat aggregative categories of consumption. It is admittedly true that each of such major categories comprises a variety of comodities which are not quite homogeneous in terms of their behaviour characteristics such as Engel elasticities. The degree of disaggregation required in a demand analysis certainly depends on the particular purposes for which it is supposed to serve. But the ordinary major categories of consumption expenditure may not be too suitable to the context of demand projections for industrial planning purposes, where similarity of production process is a more important criterion for commodity breakdown than similarity of use. To re-evaluate the demand patterns estimated for consumer budget categories in terms of industrial classification categories is in fact a serious job of projection practicians and often involves flimsy patchwork. An ideal set of reference patterns should thus preferably be conceived in terms of such highly disaggregated categories that it may be easier to regroup them into broader categories as the need arises.

A minute evaluation of the behaviour of demand for a less composite commodity highlights the problem of substitution and complementarity among related goods. The estimation of own and cross price elasticities is only a part of the whole task, since such concepts can be gainfully applied for projection purposes only if the future cost price conditions of the products considered are predictable to a reasonable extent. In the case of a long-run projection, the ease of supply and the intensity of demand are both likely to be correlated with a general index of economic development and more so in the context of an international reference pattern which is in principle abstracted from peculiarities of individual countries. It does not necessarily follow, however, that it is enough to have only income (or total expenditure) as the independent variable. As the degree of disaggregation increases, chances are that some catch-all variable like time plays the more important role in evaluating the significance of such factors as price changes and demonstration effects. Of course, time effects in the present context do not concern particular trends in a particular country, but rather the trends that can be observed commonly or systematically for a number of countries in the world.

[44] However, the *F* ratios are not extremely high, considering that the critical values of *F* at the 99 per cent confidence level lie around 2.4 to 2.9 for the relevant degrees of freedom; and the difference of regressions of type (*b*) for furniture, furnishings and household equipment is in fact not significant at this confidence level.

An illustration is given hy an analysis of the cross-country pattern of radio receiver holdings, the result of which is depicted in chart 2. The rate of holding of radio receivers is measured by the numher of licences issued per hundred population for each country and is regressed upon *per capita* gross domestic product (GDP) at factor costs in 1961 dollars. The equation used for statistical estimation is the cumulative log-normal, with the saturation level set at 50 licences per hundred population according to the graphical approximation method. The United Nations Educational, Scientific and Cultural Organization (UNESCO) data for number of licences issued[45] do not exactly represent the number of receivers in use since a licence may cover more than one receiver in the same household. But the estimates of the number of radio receivers are available for a much smaller number of countries (which have no licensing system) than the number of licences. Selecting two different years, 1953/54 and 1960/61, for the purpose of inter-temporal comparison of cross-country patterns, the analysis is based on the data for number of licences alone for a total of forty-six countries (the same countries for both years). Unfortunately the purchasing-power parities are not readily available for the majority of these countries; therefore conversion of GDP data into dollars is done for all the countries by means of official exchange rates, mostly similar to those employed in a recent (1962) issue of United Nations, *Yearbook of National Accounts Statistics*;[46] 1961 is taken as the base year and the levels for other years are obtained from extrapolations using the trend rates of growth in GDP at constant prices during the nineteen fifties.[47] The two cross-section regressions give the following estimates for the parameters of the log-normal function:

(1) 1953/54: $t = -6.5076 + 0.9371 \ln y$; $R^2 = 0.917$
$(\pm 0.2513)\ (\pm 0.0425)$

(2) 1960/61: $t = -5.5557 + 0.8095 \ln y$; $R^2 = 0.886$
$(\pm 0.2612)\ (\pm 0.0436)$

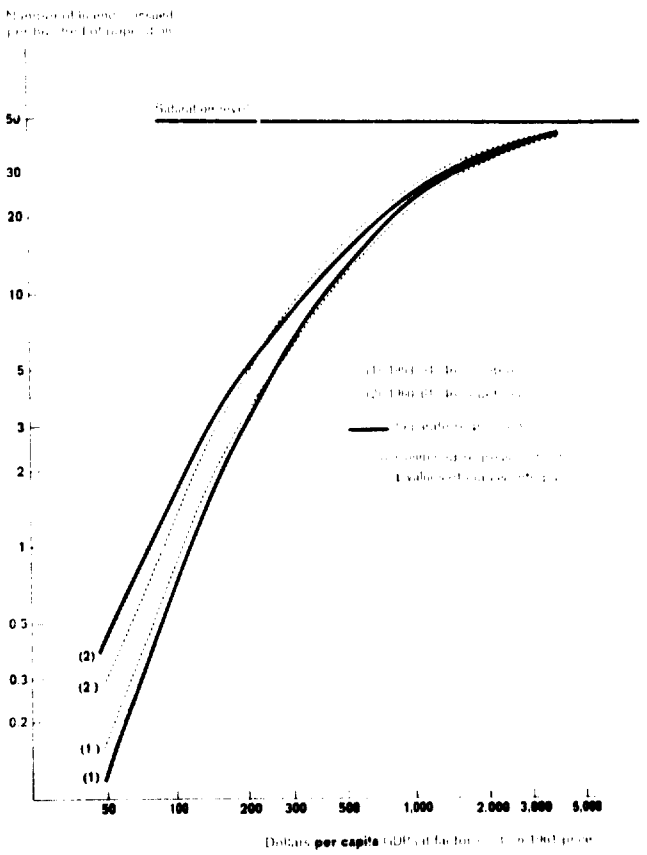
The comparahility between these two regressions is indicated hy the following analysis of variance:

	Sum of squares	*Degrees of freedom*	*Mean sum of squares*
Over-all regression	70.87308	1	
Difference of regressions	0.36857	1	0.36857
Difference of positions	1.04462	1	1.04462
Combined residuals	10.90937	88	0.12397
Total variation	79.66997	91	

This analysis implies that the cross-section relationships between t and $\ln y$ for the two years can be approximated by a pair of parallel lines, and that the position of the regression line for 1960/61 is significantly higher than that for 1953/54; in other words, there is a significant upward trend in the rate of holdings of radio licences. It should be noted, however, that this autonomous trend rate is not the same for all countries, but is systematically higher for a lower level of *per capita* GDP. This conforms with the fact that the radio broadcasting system has gained increasing popularity in many newly developing countries during the past decade; the increase in the numher of licence holders was often so sharp that it had almost no clear-cut relation with the increase in the general standard of living. In developed countries, on the other hand, radio hroadcasting was already well established hy the end of the nineteen forties or even earlier, so that the rate of holding showed generally a stable pattern in relation to *per capita* GNP. The pattern was ohscured in some of these countries hy the new surge of television broadcasting, not to speak of the possible changes in the normal relationship between the number of licences and the number of radio receivers due to the increased popularity of transistor radios in recent years.

Chart 2

CROSS-COUNTRY REGRESSIONS (1953/54 AND 1960/61) OF THE NUMBER OF RADIO LICENCES ON *per capita* GDP: CUMULATIVE LOG-NORMAL



Source: See foot-notes 45 to 47 in the text.

The assumption of parallelism gives the following estimators for the log-normal function:

(1′) 1953/54: $t = +6.12896 + 0.8706 \ln y$
(2′) 1960/61: $t = +5.91657 + 0.8706 \ln y$

The different time effects for different income levels

[45] United Nations, *Statistical Yearbook* for various years between 1958 and 1962.

[46] *See* part D, table 3.

[47] Obtained in most cases from *ibid.*, table 2A.

can be read off as the distance between the pair of dotted curves in chart 2.

It may be worth mentioning that the test of parallelism shown above is in fact not strictly acceptable in this particular example. The reason for this is that correlations are readily expected to exist between the two cross-section sets because both sets are composed of data for the same countries as at the different points of time. To determine whether the regression relationship varies at different points of time, allowance must be made for the correlation introduced by country effects. If it can be assumed that country differences introduce an additive effect, this can be eliminated by deducting country means from each of the values for the country. The comparison of regressions is then based on residual variations.[48] If the assumption of additivity cannot be maintained, a more general form of correlation should be assumed for the effect of country differences; the analysis must then be designed so as to obtain the variance and standard error of the difference between the regression coefficients estimated from the two samples. In any case, the procedure involves a similar computational burden in obtaining the sum of products of the observations in one sample with those in the other sample.[49]

An application of Carter's method results in the following analysis of residual variance:

	Sum of squares	*Degrees of freedom*	*Mean sum of squares*
Mean residual regression	0.09486	1	
Difference of residual regressions	0.22613	1	0.22613
Separate residual regressions	0.32099	2	
Reduced residual variation	0.91406	43	0.02126
TOTAL RESIDUAL VARIATION	1.23505	45	

Alternatively, an application of Yates' method proves that the standard error of the difference between the two regression coefficients (0.9371 − 0.8095 = 0.1276) is as small as ±0.0098. Hence, time effects during the seven-year period are significant in terms of both locational parameter and dispersion parameter of the log-normal function. This only reinforces the conclusion obtained from the former test as regards the distribution of differential time effects over low-income and high-income countries. The same conclusion suggests, however, that the analysis has not yet revealed any reference pattern that could be stable enough for its projection into future years. If it is safe to assume that, after the big surge of the nineteen fifties in the development of radio communications in newly developing countries, the next decade—at least the latter half of the nineteen sixties—will witness the tapering off of the autonomous trend, a much higher degree of stability may be assigned to the 1960/61 pattern than one might have expected for the 1953/54 pattern if it had been used for a projection for the latter half of the nineteen fifties.

What is really important from the standpoint of an individual country is the characteristics of the deviations from the normal, either temporary or persistent, of the country's actual position, rather than this stochastically normal position. A reference pattern, *per se*, merely implies the positions that are most likely to be observed for countries at varying stages of economic development; the propriety of such positions for any particular country is a matter of judgement that can be dealt with only in the light of the country's particular needs, resources and policies. The stability of a reference pattern thus implies, not necessarily that the majority of countries move *along* the reference pattern,[50] but at least that their movements in time, varying radically in both direction and pace from one country to another, would on the whole maintain the deviations from the pattern to an extent no greater than observed at present. As a stronger hypothesis, one might at most expect that a country below (or above) normal would grow faster (or more slowly) than at the rate implied by a movement along the reference pattern.

The testing of the strong hypothesis requires a systematic investigation of the time series of individual countries.

The main purpose of the present report is to clarify the methodological issues rather than to complete the empirical analysis in pursuit of definite and unique conclusions. A fuller treatment of the above issues, which would make use of a more extensive collection of relevant data, is certainly a desirable work programme for the future.

[48] *See* A. H. Carter, "The Estimation and Comparison of Residual Regressions When There Are Two or More Related Sets of Observations", *Biometrica*, vol. 36 (London, 1949), pages 26 to 46.

[49] *See*, for example, F. Yates, "Tests of Significance of the Difference Between Regression Coefficients Derived from Two Sets of Correlated Variates", *Proceedings of Royal Society of Edinburgh*, vol. 59 (1939), pages 184 to 194.

[50] In the present example, the movement along the two reference patterns implies the following values of income elasticity coefficients:

Per capita GDP level (dollars)	*Elasticities with respect to per capita GDP*	
	Along the 1960/61 pattern	*Along the 1953/54 pattern*
50	2.202	2.870
100	1.801	2.378
200	1.414	1.813
400	1.051	1.348
800	0.720	0.896
1,500	0.475	0.552
2,000	0.372	0.426

CRUDE METHODS OF PROJECTION FOR INDUSTRIAL CONSUMPTION

Various methods

It is true indeed that, in dealing with producer demand, projection of activities in other particular productive sectors from which the demand for a given commodity originates should be readily available, either in the form of a formal development programme or as a more or less approximate estimation of future structural change in the economy. If no such data are ready as yet, or if projections of future demand are needed for a preliminary construction of such data, various devices for cruder approximations will be in order.

Under such circumstances, even an analogy with household consumption behaviour may be useful to some of the producer goods as well. Especially for certain intermediate goods and services which are used as inputs for a wide range of activities, the future trend of demand may be rather legitimately correlated with the trend of general economic activities indicated by, say, GNP or output of some major sector of the economy; intermediate goods which are only one step removed from the stage of final delivery, such as textiles and leather products, may also be treated as quasi-consumer goods as far as the long-run behaviour of their demand is concerned. The projection invariances in such an approach are of a nature somewhat similar to the behavioural parameters in household consumption analysis, such as elasticities and marginal propensities. A simpler extrapolation method based on time trend or own trend should also be included among the candidates.

Independent variables that are to be incorporated in projection formulas can be selected among various candidates, such as time, population, consumption's own level, GDP (or GNP), gross domestic capital formation, industrial production and so on. The selection depends, *inter alia*, upon: (i) availability of desirable data; (ii) type of commodity considered; (iii) degree of aggregation involved in the commodity concept considered, and (iv) predictability of would-be independent variables.

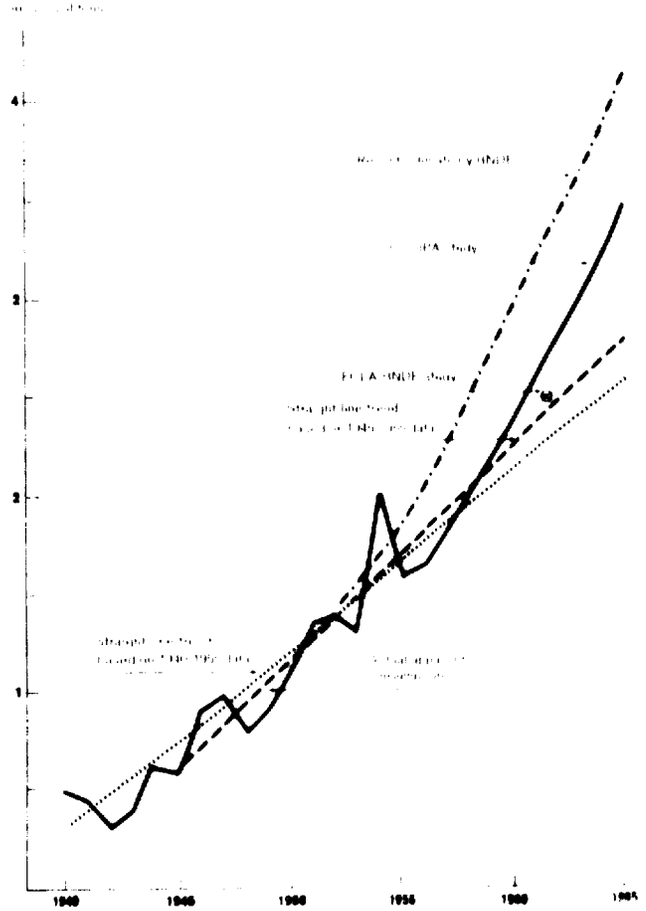
The extrapolation of a historical trend taking time as the only explanatory variable is certainly the simplest of all projection methods. If everything else were expected to change at the same pace as it used to in the past, or if the influence of a number of conceivable causative factors were believed to keep offsetting one another, the pace of history might as well be left in the hands of its own inertia. The firmer the historical trend looks, the stronger the anticipation becomes that it will continue in the future. Even though nothing more is implied in this method, the extrapolation of a firm historical trend may provide a preliminary benchmark against which the results of other more sophisticated projections can be checked.

A firm historical trend is not such a common thing to be observed, however; the number of observations (years or half-years) must be large enough for a medium-term or long-term trend not to be overwhelmed by short-term fluctuations; besides, to distinguish relatively normal years from relatively abnormal years (for example, years during which severe import restrictions resulted in a temporary cut-back in actual consumption), concrete factual data must be used rather than a mechanical procedure of curve-fittings. Even if the past trend is found to be firm enough, the anticipation of more rapid structural transformation in the future than in the past, which is indeed the case for developing economies, would make its extrapolation quite vulnerable.

For example, the time series of apparent consumption of crude steel (calculated as the sum of domestic production and imports) in Brazil for the period 1940 to 1955 indicated a remarkably rising trend. A variety of extrapolations have been invited as shown in chart 3. The first projection was based on an extrapolation of the linear trend with a constant annual increment observed during the period 1940 to 1955. The second projection took the period 1945 to 1955 as a basis, excluding the years 1940 to 1944 when imports were at an obviously abnormal level owing to the war; the linear trend extrapolations thus resulted in the projec-

Chart 3

Extrapolations of the demand for steel ingots in Brazil



Source: United Nations, "Rolled Iron and Steel Products in Latin America: Prospective Production and Demand", *Economic Bulletin for Latin America*, vol. IV, No. 2, 1959 (Santiago).

tion of 2.8 million tons in the case of the latter and 2.58 million tons in the case of the former for 1965. Instead of drawing other alternative trend lines on the same data, it would be interesting to see what could be obtained by applying different methods.

The 1956 Companhia Siderúrgica Paulista (COSIPA) study used a more sophisticated method, relying primarily on the correlation of the index between *per capita* crude steel consumption and the industrialization rate (ratio of industrial production to that of GDP), which was estimated on the basis of the observations for a number of countries.[51] This gave the demand for crude steel for 1965 of some 3.462 million tons, which is a considerably higher figure than the above two hypotheses gave. The joint study by the Economic Commission for Latin America (ECLA) and the Banco Nacional do Desenvolvimento Econômico (BNDE) of the demand for rolled steel products in Brazil,[52] on the other hand, used a simple end-use approach, assuming that steel demand by each consuming sector (mechanical industry, construction, agriculture and railways) would grow at the same rate as the output of that sector was expected to grow; converting the result into ingot equivalent, the projected level of demand for 1962 turned out to be very close to the extrapolation of the 1945 to 1955 linear trend. All these projections seem to be rather pessimistic: taking into account the expected increase in population from 58 to 74 million during the period 1955 to 1965, even the least pessimistic projection by the COSIPA gives only an 80 per cent increase in *per capita* steel consumption.

The BNDE thus revised the estimate by dividing the total apparent consumption into several product categories (tin plate; sheet, tubes and other flat products; shapes and drawn wire), for each of which a semi-logarithmic (constant *rate* of growth) trend line, fitted on the 1947 to 1956 data, was extrapolated. This concerns only the part of steel demand that is not involved in the known development projects (for the railway re-equipment, motor vehicle producing and shipbuilding programmes). Adding the independent projections for the latter, the 1965 annual requirement of steel ingots is estimated at 4.12 million tons.[53]

In order to analyse the variation of historical trend rate of growth among a number of countries, some explanatory variable other than time must be introduced. There is one sophisticated way, however, to let time alone speak a little more.

When the rate of increase in consumption g is made a function of the level of consumption C itself, in such a form as:

$$g_t = \alpha C_t^{-\beta},$$

it is known that the integral of this function gives the level of consumption as a function of time alone, namely,

$$C_t = \sqrt[\beta]{\alpha\beta(t - t_0)},$$

where t_0 denotes the initial year in which consumption just started to increase from the zero level. It will be noted that this scheme involves essentially the same notion of law of growth that is represented by an asymptotic curve with time, such as the Gomperz and the logistic.

By applying the same formula to the time series of world steel production covering the period since 1868, the Economic Commission for Europe (ECE) Steel Committee obtained the regression equation:

$$\log\left[\frac{100\,(A_{t+1} - A_t)}{A_t}\right] = 1.30436 - 0.22197 \log A_t,$$

where A_t indicates the annual world steel production (in millions of tons) obtained from the five-year moving averages of annual observations. The integrating of this equation gives a formula of world steel production as a function of time, namely,

$$A_t = [0.044736\,(t - t_0)]^{(1\,/\,0.22197)},$$

in which t_0 equals approximately 1850.51.[54]

The ECE study on steel consumption also observed on the basis of cross-country analysis somewhat impressive relationships between *per capita* steel consumption and a selected macro-economic variable such as *per capita* value of GNP, gross domestic capital formation, private consumption expenditure and industrial output. When the sample was split into a low-income group and a high-income group, for example, the slope coefficients with respect to *per capita* GNP were found to vary considerably between the two groups, implying decreasing rates of growth in *per capita* steel consumption at the more advanced stage of economic development. However, without elaborating the analysis along this line any further, the ECE projections of steel consumption were finally perched upon the almost equally impressive asymptotic curve with time. If there is any advantage in the latter method, it is only that it can avoid the trouble of making a projection of any other independent variable.

Introducing explanatory variables other than time will naturally raise the question of predictability of such variables themselves. The difficulty is fortunately not too serious in the case of macro-economic variables, for they are usually the elements whose projections should be made available at the earliest phase of perspective planning. Among the candidate variables of more or less aggregative characters, an appropriate one may be selected in view of the tightness of its behavioural linkage to the commodity considered. Ob-

[51] The estimated equation was: log (*per capita* steel consumption) = 0.43155 + 0.04324 × (industrialization rate). Population was projected independently. This information is supplied in "Rolled Iron and Steel Products in Latin America: Prospective Production and Demand", op. cit., pages 1 to 32.

[52] United Nations, *Analysis and Projections of Economic Development, II: The Economic Development of Brazil* (Sales No.: 56.II.G.2), pages 65 and 66.

[53] "Rolled Iron and Steel Products in Latin America", op. cit., page 13.

[54] United Nations, *Long-term Trends and Problems of the European Steel Industry* (Sales No.: 60.II.E.3), page 124.

viously, the behavioural linkage will be expected to be the more stable, the closer is its assimilation with a technological coefficient. At this highly aggregative stage, however, an *a priori* consideration in this matter does not necessarily prove to work well on empirical data.

In a United Nations study of non-ferrous metal absorption,[55] an investigation of the time series of the nineteen fifties in individual countries indicated that in the Federal Republic of Germany, for example, the variation of metal absorption was more closely geared to the variation of manufacturing production than to that of GDP, whereas the considerably erratic behaviour of annual metal absorption data in the United States did not conform any better with the movement of manufacturing output than it did with GDP. For some categories of non-ferrous metals, a closer annual relationship was observed with particular groups of industries, such as durable goods or machinery, than with manufacturing as a whole, in the case of the United States; also, some improvement seemed to be achieved by using the data on shipments by metal fabricators and thereby keeping the relationship rather free from the disturbing influence of changes in manufacturers' inventories; moreover, the use of quarterly or semi-annual data instead of annual data sometimes brought about further improvement: for example, a significant relationship was found between semi-annual changes in shipments by copper fabricators and the corresponding changes in the index of output of machinery and related products. Elaborate investigation may thus gradually lead to more reliance on the end-use method than on the cruder scheme of macro-economic approximations.

If a projection can be started with a macroscopic approximation, it can never be ended there. A more realistic appraisal of future trends inevitably leads to the analysis of the various major sources from which an over-all demand originates. Of course, as mentioned before, demand relationships and the rational invariances involved in them may be the more easily verified as they apply to the smaller homogeneous segments of a given composite item of demand. The outlook of competition of substitutes widens correspondingly, however: the number of independent variables and assumptions that have to be made for their projections will have to increase accordingly. Whatever the advantage of end-use projection, its feasibility depends, for one thing, on the availability of relevant data for establishing stable relational concepts—technological, semi-technological or behavioural coefficients. The predictability of independent variables (end-use sectors) is another important department; the problem becomes further complicated if the mutual consistency among individual end-use projections is brought into focus.

Thus, practically eligible end-uses may often be limited to somewhat aggregative concepts because of the paucity of relevant information; also, in the absence of a complete input-output projection, the projections of individual end-use sectors have to be carried out independently of one another by means of extrapolations of historical trends or of some relevant macro-economic relationships. A crude version of end-use approach in this sense has a rather limited practical meaning, and its basic methodological tools are not essentially different from those involved in the macroscopic approach mentioned above.

An exercise on this level may be exemplified by the analysis of lead absorption in the United Nations study just referred to.[56] In this example, the forms of lead absorption (or use of lead products) are separated into four major categories: (i) storage batteries and tetra-ethyl lead, (ii) pigments, pipes and sheets, (iii) cable covering and (iv) others, on the ground that each of these categories (except the last one) might be associated more or less directly to a single major sector: automobile industry for batteries and tetra-ethyl, construction industry for pigments, pipes and sheets, and electric energy production for cable covering. This leaves about 30 per cent of total absorption unassociated, involving mostly alloys such as solder, bearing metals and type metals, the use of which is rather widely distributed over many industries; it was thus linked with a more aggregative variable—industrial production. The selection of these major end-use sectors also took into account the advantage that more or less ready-made projections were available for these sectors in the United States. The historical relationship for each category of absorption appeared to be such that the technical coefficient, expressed as the ratio of each category of lead absorption (measured in tons) to the value of its associated variable, was not constant but gradually declined during the past decade. These coefficients therefore were extrapolated to the future dates along their semi-logarithmic trend lines, except in the case of tetra-ethyl, for which a reversal of the past trend was postulated for the future on the assumption that the impact of reformed gasolines (substituting for tetra-ethyl) on the use of tetra-ethyl per unit of gasoline would no longer continue.

The above treatment relates only to the data of the United States. Inadequacy of information regarding specific end-uses makes it difficult to apply even an equally crude approach to many other countries. The United Nations study thus concluded in favour of a more generalized macroscopic approach, particularly for the purpose of global projections.

Often it has been found that, as regards relatively developed countries, the difference of projection results between the end-use method and the macroscopic method happens to be of negligible significance. The ECE report by a group of experts on the method employed for the projection of electric energy consumption, and the report of the European Coal and Steel Committee (ECSC) on coal consumption projections obtain similar findings in this matter.[57] One may also recall the classical ex-

[55] United Nations, "Prospective Demand for Non-agricultural Commodities: Problems of Definition and Projection Methodology" (mimeographed document E/CN.13/49), especially pages 69 to 71.

[56] *Ibid.*, especially pages 40 to 47.

[57] *See* ECE-EP Workpaper No. 23, November 1954, and the Second Report of the High Authority of the European Coal and

periment made in the United States, in which the projections of industrial outputs obtained by a 40 x 40 input-output table were compared with those obtained by a cruder regression model in which each specific industry output was related to GNP and time alone.[58] The multiple-regression forecasts turned out to be more accurate than those based upon the input-output model, certain basic assumptions being commonly applied to both approaches. This type of competitive trial of serious, though perhaps immature, models against crude and naïve models is, however, of minor importance with regard to the decision concerning the advisability of continuing development of the former models. Especially in the case of developing countries, future changes in the economic structure should be more radical than those anticipated in more developed countries. Explicit allowance for foreseeable structural changes in evaluating an over-all magnitude of demand is likely to give a rather different result from that obtained without such allowance.

The significance of macro-economic variables in explaining the growth pattern of demand is sometimes so self-evident that even the knowledge of the rate at which demand increases is of little relevance, unless it is possible to distinguish among specific types of commodities involved in a given composite-commodity concept. For example, one can easily expect that an increasing amount of machinery and equipment is required with economic development and that a correlation of the consumption of machinery and equipment as a whole with the data on GNP, capital formation or industrial production would not fail to give a significant result.

On actual trial, such relationships came out to be impressive. For example, through correlation of *per capita* apparent consumption of machinery (measured in dollars) with *per capita* GNP (also measured in dollars), the elasticity coefficient was estimated at a little over 1.4 on the basis of cross-country data; on the other hand, the elasticity with respect to value added by manufacturing appeared close to unity. The informative value of such estimates is quite limited, however, since an enormous variety of products is left hidden behind the term "machinery." In determining a concrete outlook of import substitutions in this field, some disaggregation of the machinery concept and identification of major end-use sectors would become an indispensable step.

Reference patterns based on the crude methods

In the context of an international reference pattern, any simple model would have to involve some indicator of general economic activity comparable among countries; candidate explanatory variables are thus typically obtained from more or less aggregative concepts in national income statistics. Once a candidate explanatory variable is chosen, the rest of the work is rather similar to that related to the estimation of consumer demand relationships discussed in the preceding section.

The following examples are drawn from the series of projections of paper and paper-board demand published by the United Nations during the past few years. The successive modifications in projection formulas and use of different kinds of data in these studies would help to indicate some basic analytical problems which are commonly involved in the conception of reference demand patterns for both consumer and producer goods.

These projections are largely based on certain forms of relationships between the growth of *per capita* paper and paper-board consumption and that of *per capita* GDP. In the case of paper for educational purposes (newsprint and printing and writing paper) other explanatory variables have also been tested, such as literacy, educational activities, printing and the like, but the results have not been satisfactory probably because of the dearth of quantitative data. The first projection (made in 1953) adopted a log-linear relationship between the *per capita* levels of paper consumption and of national income, which was estimated on the basis of data for twenty Latin American countries and eleven others referring to the year 1949.[59] The log-linear relationship involves a constant-elasticity coefficient that is asssumed to be common to all countries. This assumption apparently fails to incorporate the possibility of varying income elasticity at varying *per capita* income levels, which is actually observed in the data for cross-country variations both of the consumption level in a given year and of the rate of increase during a given time period.

The revised projection[60] thus introduced a log-polynomial of second degree, namely, instead of the constant-elasticity formula, the parabolic form:

$$\log (C/N) = \log \alpha + \beta \log (Y/N) + \gamma [\log (Y/N)]^2$$

was fitted on the data averaged for 1948 to 1952 for slightly over thirty countries, including all the Latin American ones. Measuring *per capita* consumption (C/N) in kilogrammes and *per capita* net geographical product in dollars, the following results were obtained:

	$\log \hat{\alpha}$	$\hat{\beta}$	$\hat{\gamma}$
Newsprint	—1.2525	2.4082	—0.1876
Printing and writing paper	—3.7895	4.1601	—0.5022
All other paper and board	—1.2047	2.4142	—0.1489

Steel Committee, 15 October 1953. The ECLA study on the prospective demand for energy in Latin America, *Energy in Latin America* (Sales No.: 57.II.G.2), also favours the macroscopic approach mainly based on the cross-section regression of *per capita* consumption on *per capita* GDP, although it admits that a selective analysis of various economic sectors would provide a more accurate basis for projection.

[58] Harold J. Barnett, "Specific Industry Output Projections", *Studies in Income and Wealth: Long-range Economic Projections*, National Bureau of Economic Research (New York, 1954), vol. 16, pages 191 to 232.

[59] United Nations, *Possibilities for the Development of the Pulp and Paper Industries in Latin America* (Sales No.: 53.II.G.2).

[60] United Nations, *Pulp and Paper Prospects in Latin America* (Sales No.:55.II.G.4), pages 42 and 43. This is a compendium of studies submitted to the Latin American Meeting of Experts in the Pulp and Paper Industry held at Buenos Aires in 1954.

In order to speak of the meaningfulness of such cross-section estimates of elasticities in a dynamic context, it is always important to supplement the analysis of cross-country variations with that of over-time variations. For the latter, there are at least three possibilities: (i) the time series of regional aggregates; (ii) the time series of a number of individual countries first to be analysed separately and then combined into a standard pattern by means of co-variance analysis, and (iii) transformation (by means of some simple analytical formula) of within-country variations into the form suitable to the analysis of cross-country variations, the regression equation for the latter being obtained by differentiating the original demand function with respect to time.

The first one is the easiest since the time series of global aggregates are usually available for a somewhat long time period (because of relatively high weights assigned to advanced countries in such data) going back even to the pre-war years; but an analysis of global data as such would have very little implication for assessing the standard behaviour of an individual country.[61] The second method is a rather ideal one, and an example of its application was already presented with reference to the analysis of household consumption. In most of the newly developing countries, however, available time series are seldom large enough for the fitting of a second-degree curve. The assumption of constant income elasticity should be practically sufficient to handle the annual data of an individual country for less than a decade, although the time series elasticity estimated in this way would vary among different countries, part of the variation being explained, if at all, in terms of the different income levels of these countries. The last of the above three methods provides a short-cut practice for incorporating time series observations into cross-country analysis. As regards the particular example mentioned above, the income elasticity involved in the log-parabola can be expressed as:

$$\eta_{cy}=\frac{d \log (C/N)}{d \log (Y/N)}=\beta+2\gamma \log (Y/N).$$

If the value of η_{cy} is observed for each country as the results of estimation of, say, a log-linear relationship on the basis of time series data (either by free hand or least squares), the unknown parameters in the right-hand side of the equation can be estimated by means of ordinary cross-section regression, involving the η_{cy} thus observed as the dependent variable.

In fact, this method was employed in one of the ECLA/FAO joint studies on paper and paper-board consumption.[62] The parameters in the above equation were estimated as follows:

	$\hat{\beta}'$	$\hat{\gamma}'$
Newsprint	6.23	—0.90
Other paper and boards	6.46	—0.95
Importing countries	5.24	—0.76
Exporting countries	7.68	—1.05

The results are radically different from those obtained from the 1949 cross-country data referring to consumption levels alone. For example, the normal values of income elasticities of newsprint consumption corresponding to *per capita* income levels of $100 and $1,000 are 2.63 and 0.83, respectively, while according to the earlier estimates the corresponding values remain 1.04 and 1.28, respectively. Although the values corresponding to the $500 income level turn out to be about the same (around 1.40) in both cases, the tendency of diminishing elasticities appears to be much stronger when the time series observations are taken into account.[63]

Incidentally, it should be noted that the above formula for relating the time series elasticities to *per capita* income levels does not permit the determination of a normal level of consumption. From the given estimates of $\hat{\beta}'$ and $\hat{\gamma}'$, the predicted level of *per capita* consumption may be expressed as:

$$\log (C/N)=\hat{\beta}' \log (Y/N)+\hat{\gamma}' [\log (Y/N)]^2+k,$$

in which k depends on the existing relation of paper consumption level to income level in each individual country; if the normal level of consumption is considered to be as important a concept as the normal rate of increase, a standard value of k may be arbitrarily assigned in accordance with the average observations for a given universe (sample, in fact), otherwise—for the sake of consistency—all the parameters have to be re-estimated by rearranging the formula for regression analysis as well as the basic data.

The log-parabola demand function with a negative coefficient on the second-degree term has a maximum point, which may be considered to indicate a saturation level of consumption. The recent FAO study on world demand for paper and board to 1975[64] employed a different type of formulation, namely, a cumulative log-normal distribution function.

The reason for selecting this type of formulation was mainly that the projection concerned the very long period stretching from the mid-nineteen fifties to 1975. Since the projection was conceived primarily in a global context, the analysis was based, among other things, on the historical series of *per capita* data averaged by region:

[61] Time series data aggregated by geographical regions (such as North America, Latin America, western Europe, the Far East, Africa and the Middle East) may also be chained into a consecutive series as though they represented the successive phases of the history of a single hypothetical region. This method was applied in the FAO study, *World Demand for Paper to 1975*, which will be discussed shortly.

[62] United Nations, "Chile: Potential Pulp and Paper Exporter" (mimeographed document E/CN.12/424/Rev.1). This report concerns specifically the technical and economic possibilities for the establishment of a paper and pulp export industry in Chile as one of the links in a regional development plan for Latin America. It was prepared by the Pulp and Paper Advisory Groups to Latin America.

[63] They happen to agree to a remarkable extent with the estimates derived from applying the cumulative log normal functions to regional time series (*see* table 9).

[64] Food and Agriculture Organization of the United Nations. *World Demand for Paper to 1975: A Study of Regional Trends* (Rome, 1960). *See* the first section of the present study for the characteristics of log-normal demand functions.

1939 and 1947 to 1956 for North America, 1938 and 1948 to 1956 for eastern Europe, 1947 to 1956 for Latin America (excluding Argentina), 1952 to 1954 average for Africa (five countries including the United Arab Republic) and 1952 to 1954 average for the Far East (six countries excluding Japan). All these annual observations were chained into one series as though it represented the long history of a hypothetical country with *per capita* income increasing from some $80 up to $2,000 or more.

In estimating the log-normal demand function, the saturation level was obtained by the graphical method of approximation. Table 9 summarizes the estimates based on the historical regional data. α and β in the table are the parameters in the regression equations for the t values of Gauss' integral, that is:

$$t = \beta \ln (Y/N) + \alpha.$$

Of course a similar analysis can be applied to the cross-section of individual country data at a given point of time. Using the 1952 to 1954 average data for the countries included in the regional series, the resulting cross-section estimates of income elasticity are compared with those obtained from the historical regional data. The comparison is indicated in the last two rows of table 9. The agreement between the results of the two approaches happens to be quite reassuring.

The term "normal" or "standard" has often been used in the present study. "Normal" in this context represents "what is most likely to be on the average" that can be expected on the basis of a systematic investigation of observed facts. The credibility of this concept depends, among other things, upon the competence of the particular statistical analysis employed in its derivation; as already discussed in connexion with household consumption, the comparability between estimates derived from different types of data—especially time series and cross-sections—constitutes an important test on that score. In this respect, the example shown above is just one of the lucky cases. One may find many other instances in which cross-sectionally estimated elasticity coefficients happen to differ significantly from those estimated from time series data. The introduction of an autonomous trend may be one way to deal with such a situation,[65] although the procedure is rather

[65] *See* the discussions in the section "International Reference Patterns", especially "Over-time comparison of cross-country estimates".

Table 9

FAO ESTIMATES OF LOG-NORMAL DEMAND FUNCTIONS FOR PAPER AND PAPER-BOARD BASED ON HISTORICAL REGIONAL DATA (EXCEPT FOR THE LAST ROW)

	Newsprint (1)	*Printing and writing paper* (2)	*Other papers* (3)	*Paper-board* (4)	*Total paper and paper-board* (1+2+3+4)	(1+2)	(3+4)
Saturation level (kilogrammes *per capita*)	60	60	80	420	620	120	500
β	0.8715	0.8228	0.7943	0.7565	0.7199	0.8486	0.7100
α	−6.4598	−6.3872	−6.1005	−6.7860	−6.1041	−6.4238	−6.2238
Demand elasticity at *per capita* GDP (1954 dollars) of:							
$ 50	2.902	2.830	2.612	3.071	2.588	2.867	2.626
100	2.418	2.406	2.200	2.716	2.239	2.408	2.300
200	1.950	1.972	1.813	2.383	1.895	1.960	1.979
400	1.498	1.565	1.435	1.977	1.575	1.530	1.665
800	1.083	1.181	1.080	1.615	1.268	1.128	1.361
1,200	0.847	0.970	0.888	1.416	1.096	0.885	1.192
2,000	0.608	0.727	0.665	1.175	0.891	0.663	0.984
$ 560	1.288	1.375	1.260	1.798	1.420	1.326	1.529
1952 to 1954 cross-section estimates (elasticities corresponding to $560 *per capita* GNP).[a]	1.317	1.275	1.351	1.666	1.442	1.322	1.572

Source: *World Demand for Paper to 1975*, pages 109 to 111.

[a] The log-normal function estimated on the basis of the cross-section of individual country data averaged for 1952 to 1954; $560 corresponds to the geometric mean of the regional historical series.

question-begging; it is always recommendable to seek additional explanatory variables to increase the stability of the normal concept considered.

In view of the use of a reference pattern for projections in individual countries, due attention should be paid to the existing deviations of these countries from the reference pattern; projections to future dates would then depend upon critical decisions in regard to possible changes in the relative deviations rather than upon mechanical extrapolations along the pattern. When the reference pattern considered is built on crude models such as those discussed in this section, there is almost nothing within the model itself that can be a guiding principle for such decisions. One could only think of the null hypothesis that there be a tendency to approach the normal, in the sense that consumption in below-normal countries is expected to grow faster, *ceteris paribus*, than consumption in above-normal countries. As for the over-time stability of the reference pattern, however, the stochastic principle on which it rests would not justify any stronger assumption than that the degree of country deviations is on the average no larger in the future than that observed at present, unless some additional variable (representing, for example, the recent growth in international communications and development assistance programmes) could be introduced to verify the stronger hypothesis.

Evidence for the strong hypothesis is not quite absent. For example, in a recent study[66] in which the main concern was to establish a simple form of international reference pattern for the growth of major manufacturing sectors, an analysis of over-time changes in the country residuals from cross-section regressions revealed a tendency that did not contradict the strong hypothesis. In addition, background research being undertaken in connexion with the present study has produced some tentative results in favour of the strong hypothesis as regards the cross-country patterns of consumption of a few basic industrial goods.[67] The evidence in this direction seems for the moment too fragmentary to be anything more than a hopeful promise; the theoretical and empirical verifiability of the hypothesis considered thus remains to be explored by further research.

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[66] United Nations, *Study of Industrial Growth* (Sales No.: 63.II.B.2), especially chapters IV and V.

[67] For example, for *per capita* national apparent consumption of aluminium, an analysis of the data for twenty-one countries for the 1950-52 and 1957-1959 averages resulted in the following form of normal pattern:

$$c_t = k\, e^{0.05t}\, V_t^{1.02 - 2.29 \log D_0}$$

where c stands for *per capita* annual aluminium consumption (in kilogrammes); V is *per capita* value added in metallurgical and mechanical manufacturing (in 1958 dollars); k is a constant relating to the consumption level of a specific country, and D_0 is the country residual as at $t = 0$ (1951) from the standard cross-section equation:

$$c^*_0 = 0.018\, e^{0.05t}\, V_0^{100}.$$

Seminar on Industrial Estates in Africa

A SEMINAR ON Industrial Estates in the region of the Economic Commission for Africa (ECA) was held in Addis Ababa, Ethiopia, from 14 to 21 December 1964.[1] The meeting was sponsored jointly by ECA and the Centre for Industrial Development and the Bureau of Technical Assistance Operations of the United Nations Department of Economic and Social Affairs. The Seminar was attended by participants from twenty-one States members and associate members of ECA, and by observers from seven other countries and from one intergovernmental organization.

The main subjects discussed at the Seminar were: the role of industrial estates and industrial areas in policies and programmes of industrial development; planning, organization, management and financing of industrial estates, and regional and international co-operation in their development. The following are some of the important conclusions and recommendations of the Seminar.

THE ROLE OF INDUSTRIAL ESTATES IN DEVELOPMENT POLICIES AND PROGRAMMES

The Seminar laid considerable emphasis on the industrial estate as an instrument for the development of small-scale industries in countries of the region. It was convinced that, provided guidance, assistance, training and support were given, small-scale industries could be set up by people from all walks of life, with small financial resources, little or no technical and management experience, and beginning operations with relatively unskilled labour. By promoting small-scale industries, particularly by means of industrial estates, a breakthrough of the indigenous entrepreneur into industrial activities and his participation in the industrialization of his country could be achieved.

It was expected that industrial estates would not only stimulate the establishment of new small-scale industrial enterprises, but also the expansion and modernization of existing ones allowed to settle on the estate. The Seminar felt that upgrading of existing enterprises by admission to industrial estates was an important objective of these programmes. Admission should be accompanied by provision of credit for renovating equipment and strengthening working capital. The basic benefits of industrial estates—common services, technical and managerial assistance, training and healthy surroundings—would further increase output, improve product quality and reduce production costs.

Rehousing of existing enterprises on industrial estates, under the same conditions, was also recommended as a counterpart of urban development and redevelopment schemes, especially slum clearance programmes.

Another major objective of small-industry promotion programmes, especially industrial estate projects, was to facilitate the growth of small-scale industry. The Seminar recommended that provision for eventual expansion of each factory building and of the estate as a whole be incorporated in its plan. A number of enterprises might, however, be able to outgrow the enlarged premises put at their disposal. The Seminar felt that, inasmuch as such enterprises fulfilled the objectives of the development programme, they should not be penalized for their success by being forced to leave the estate. Also, it considered that enterprises outgrowing the definition of small-scale industry should not be forced to vacate their premises on the estate. Such a condition might have the effect of inhibiting the growth of healthy small units which might fear to lose their benefits by exceeding the definition's limits. This would clearly defeat the purpose of the programme.

The participants felt that the device of the industrial estate should not be used for the promotion of large concerns, whether national or foreign. Large industries had the means of constructing "custom-made" factories and of securing the technical and managerial talent needed for efficient operation. Government assistance along these lines might however be required for stimulating the establishment of large-scale enterprises and for attracting capital from abroad, where necessary. Industrial areas offering improved land, utilities, transportation facilities, zoning, and the advantage of industrial clustering, were the appropriate instruments for achieving these objectives. Industrial areas could also provide improved plots to expanding industries outgrowing the facilities of industrial estates, as well as to new or existing small-scale enterprises with strong financial means and competent technical and managerial personnel, which might not need the facilities of the industrial estate.

It was felt that while resources should be found to promote small-scale industries and set up a few industrial estates, the present means at the disposal of

[1] This Seminar was the second regional meeting on industrial estates sponsored by the United Nations. The first seminar, covering Asia and the Far East and organized in co-operation with the Economic Commission for Asia and the Far East (ECAFE), was held in Madras, India, from 1 to 11 November 1961. The report of the ECAFE Seminar, large excerpts of the discussion and information papers submitted to it were published in United Nations, *Industrial Estates in Asia and the Far East* (Sales No.: 62.II.B.5). A summary of the report was published in the fifth issue of the *Bulletin* (Sales No.: 62.II.B.1).

most countries of the region would be inadequate to finance, from the beginning, any large programme in this area. The role of the first industrial estates was, however, of considerable importance. They should be devised as demonstration projects which would not only provide guidance for planning, constructing and operating further industrial estates, but would also induce local governments and private groups to follow suit. As the network of industrial estates expanded in the course of time, their radiation effect would cover a broader territory. The action of the industrial extension services set up on each estate to meet the needs of both occupants and outside enterprises would be particularly significant in this respect.

The Seminar was convinced that in countries of the region industrial estates and industrial areas would serve at the same time as instruments of industrial development and of planned location of industry. Industrial location was an integral part of any industrialization policy. In the developing countries as in the advanced ones such policy was often oriented towards decentralization, with a view to developing as far as possible all regions of a country, particularly the poorer ones, and checking at the same time the congestion of the larger urban centres. It was realized, however, that the industrial estate programmes had to be large enough to exert significant influence on the geographical distribution of industry throughout the country. In the conditions of most African countries, the latter objective had to remain for a long time subsidiary to that of promotion of industrial activity.

Planning and establishment of industrial estates

The Seminar considered that the first step in planning and establishing industrial estates was for the government of the country concerned to adopt policies and programmes oriented towards development of small-scale industries. The industrial estate was only one among the various measures for the stimulation and development of small industries, and its effectiveness lay in its integration with other schemes of assistance.

Feasibility studies and surveys were prerequisites for determining the location, site and type of an industrial estate, the size, number and type of factories and other buildings, the services and facilities required, and the costs of the project. The surveys should be concerned not only with the availability of labour, raw materials and basic facilities such as power and water, but also with the prospects of industrial development in various localities. While existing and potential demand for factory accommodation on an industrial estate should be assessed, a rigid application of the demand criterion might not be advisable in most countries of Africa. Industrial estates might be established in certain suitable locations in the expectation that they would generate the climate and incentive for new industrial ventures.

In most African countries, the best location for industrial estates appeared to be the big cities, often the capital cities. The Seminar expressed considerable interest in the industrialization of rural areas but felt that, at the present stage of development, these offered little scope for the success of industrial estates.

The Seminar noted the different concepts in industrial clustering such as industrial areas, zones, townships and estates, and discussed the merits of certain specialized types of estates. It was of the view that non-specialized industrial estates offering both general-purpose and custom-built factories and provided with common service facilities might be better suited to African countries. Provision of developed plots in industrial areas for the use of medium and large industries side by side with industrial estates with factories for small industries would be an ideal pattern of development in most African countries.

In connexion with physical planning of industrial estates, the Seminar discussed several technical problems relating to building techniques and materials, for example, construction on unstable subsoils, deterioration of building materials in tropical areas, roofing materials and design, pollution, disposal of waste products, and so on. Building research stations and similar institutions could provide information and advice on such problems, and the Seminar recommended their creation or strengthening in countries of the region.

It was felt that elaborate methods of prefabrication might be premature for many African countries, but there was much scope for standardization, dimensional co-ordination and modular design. Simplified techniques of site precasting of concrete elements should be widely used in African countries, in some of which they have already been tried with considerable success.

The Seminar recommended the undertaking of surveys of building costs in countries of the region and studies of building standards with a view to evolving a series of "norms" for use throughout the continent; and the organization of training courses and granting of fellowships for the benefit of architect planners, civil engineeers and other technicians involved in planning and building of industrial estates.

Organization, management and financing of industrial estates

There was a consensus that, because of their developmental nature, industrial estate projects would in general be sponsored and organized by the government. It was felt, however, that all facilities on an estate need not be provided by the government if feasibility studies or actual experience showed that private initiative was forthcoming to set them up. In a more general way, because of the scarcity of financial resources in most countries of the region, the government should welcome any contribution which the private sector might make to an industrial estate project. In the long run, the creation of privately sponsored co-operative industrial estates might become possible. Every form of support should be given by the governments to such initiatives by private groups.

The Seminar recommended that the number of gov-

ernment departments involved in an industrial estate project should be as limited as possible, in order to facilitate and simplify administration and operation. A large measure of autonomy should be left to the management of the estates.

It was felt that admission rules aimed at influencing industrial composition and even priority of establishment would be justified in many cases; such rules might, in particular, facilitate the early establishment and effective operation of common service facilities, which require an effective and sustained demand on the part of the occupants. A more restrictive assessment of eligibility might sometimes be justified on estates located in or near large urban centres, where entrepreneurship could be more easily stimulated, than on estates in small towns, where more liberal admission rules might be required.

Standard factories should be offered for rent, since this is one of the strongest inducements to entrepreneurship and occupancy. Rent subsidization, for a limited period on a degressive scale, could be considered as a necessary incentive. Outright sale or hire-purchase of standard buildings could be practised at the same time, but no subsidies should be provided for such transactions.

It was agreed that, in countries of the region, financial contribution from central, state or provincial government authorities would be essential at the inception of the programme. In spite of the scarcity of financial resources in most countries, some reallocation of public funds towards industrial estate projects would be necessary. In some countries, however, domestic resources could not be mobilized to the required amount and contributions from international, multilateral or bilateral sources would have to be sought.

As the programme developed and the benefits of industrial estates were demonstrated and publicized, encouragement would be given to increasing participation by private groups. In the long run, as some of the developmental objectives of the estates were being achieved, economic rents and other charges would permit recovery of a part of the initial investment. Sales of standard factories to tenants or even transfer of the whole estate to the occupants grouped, for instance, in a co-operative association would also become possible.

In this connexion, the Seminar stressed the fact that programmes of promotion of small-scale industries would be largely ineffective if sufficient capital were not made available by financing institutions to extend credit on liberal terms to new entrepreneurs or to existing industrialists desiring to modernize or expand their enterprises. It recommended that appropriate financing measures be adopted as an integral part of programmes for the development of small industries and, in particular, of industrial estate programmes. The improvements in productivity and management of small industries resulting from technical assistance, training and other promotion measures would increase their credit worthiness. It is expected that the performance of small-scale industries on an industrial estate would serve to demonstrate this fact.

The provision of common service facilities and industrial extension centres is a basic feature of industrial estates in the developing countries. The Seminar considered that the government should set up and operate those servicing facilities which could not be provided on a commercial basis. These would serve the needs of both occupants and outside industrialists.

The Seminar felt that with the possible exception of temporary rent subsidization, no special incentives should be provided to the occupants of the industrial estates, since the facilities of the estate are a powerful inducement in themselves.

Regional and international co-operation in the development of industrial estates

The Seminar was of the view that there was considerable scope for regional and international co-operation in the development of industrial estates. In many cases, such co-operation was a prerequisite to formulating, planning, financing, constructing and operating industrial estate projects. The Seminar recommended, among other things, that information on industrial estate developments in African countries be disseminated throughout the region; that research on estate and factory layout, design, use of local construction materials, and so on, and drawing up of relevant norms and specifications be undertaken by appropriate agencies on a regional or subregional basis, and that study tours, observation teams, training courses and working parties be organized for the benefit of the countries of the region.

The Seminar drew attention to the availability of advisory services and consultations on problems of small industry and industrial estate development on the part of ECA and the Centre for Industrial Development, including, if need be, assistance for the preparation of submissions to the United Nations Special Fund. Expert advice and fellowships could be requested from the United Nations under the regular and expanded programmes of technical assistance for operations of relatively limited scope and duration, and under the programme of the Special Fund for more important projects.[2]

[2] The report of the Seminar, some of the discussion papers prepared for the meeting and a survey of industrial estate developments in countries of the region will be published by the United Nations in 1965 in a volume entitled *Industrial Estates in Africa*.

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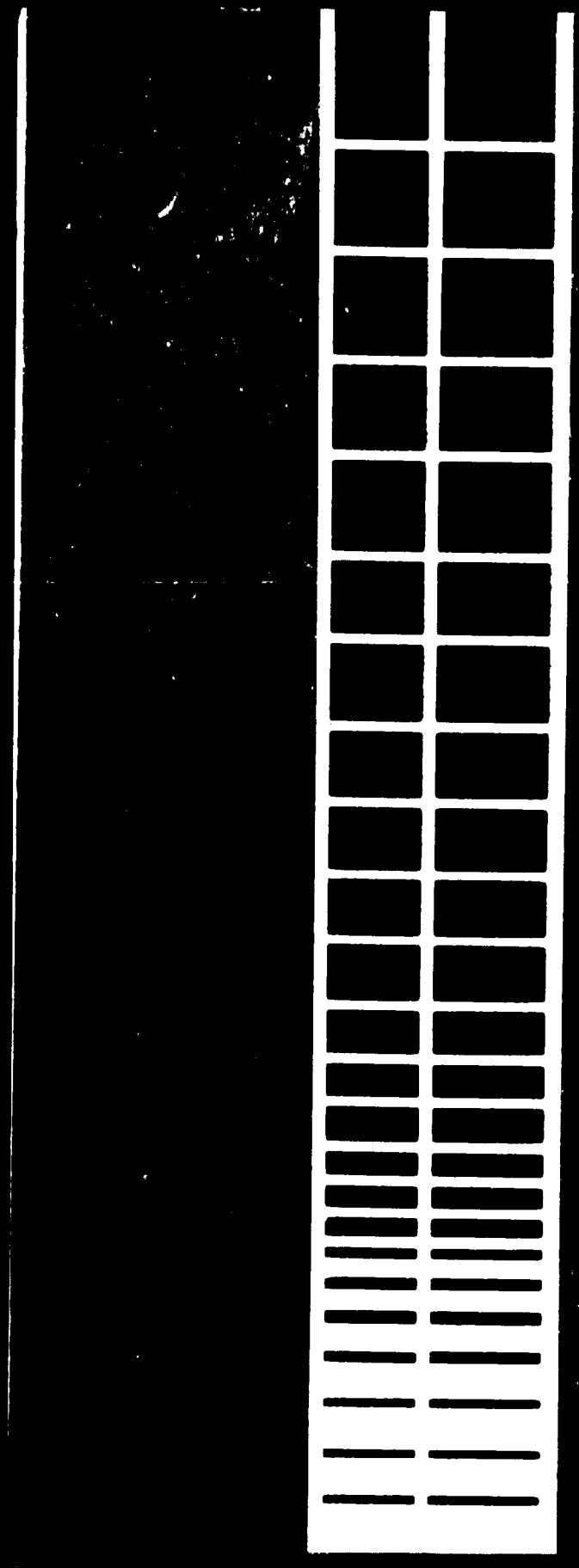
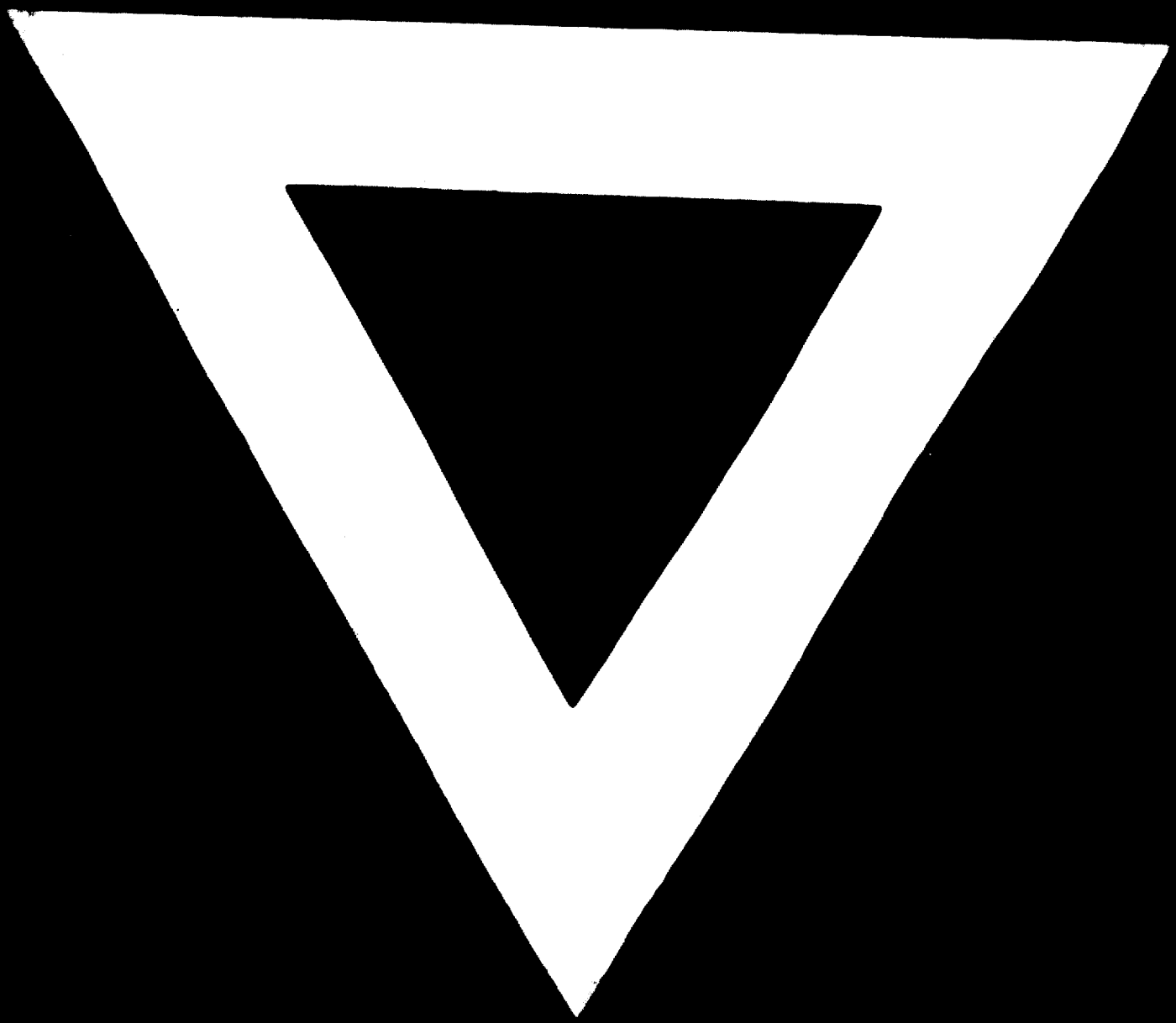
Printed in U.S.A.
10521—June 1965—4,200

Price: $U.S. 0.75
(or equivalent in other currencies)

United Nations publication
Sales No.: 65.II.B.6





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