

INVESTMENT CRITERIA AND
ECONOMIC DEVELOPMENT

by

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I. INTRODUCTION

This paper is essentially a review, in general terms, of some of the problems and formulations of investment criteria in under-developed but developing countries.

Economic development has become nowadays the foremost important national goal in under-developed countries where the "revolution of rising expectations" awakens their people to the recognition that poverty is not inevitable. If we take national product as a practical concept of economic welfare, then economic development is to increase an economy's total as well as per capita national product or real national income long enough to make the process an accumulative and self-sustained one. In achieving this, the economy will have to undergo changes, make adjustments, and even call for sacrifices on the part of the people.

What are the basic factors in economic development? Many explanations have been offered. There are the obvious and direct factors such as natural resources, capital accumulation, entrepreneurial and managerial ability, and skills and technology. Less obvious but not less important are such indirect factors as institutional framework (government, family, the market, the fiscal and monetary system, etc.), cultural beliefs, and value systems. Also, there

are some psyche-sociological themes offered for the explanation of the start of change process: Rostow's propensities,¹ McClelland's achievement motivation,² and Hagen's subordinated group and entrepreneurial class.³ All of these factors have been given different weights by different authors, yet none of them is the universal answer: for economic development is all of them, though in varying degrees under different circumstances.

Our interest here is with the capital accumulation (formation) aspect of the problem. It should be pointed out that capital formation is not the only or even the most important determinant or prime mover in the process of economic development and change. The multi-dimensional nature of the process as shown by historical experiences simply rejects any straightforward causal relationship between simple economic magnitudes. As has been well said by Bauer and Yamey, "It is often nearer the truth to say that capital is created in the process of development than that development is a function

¹W. W. Rostow, The Process of Economic Growth, W. W. Norton, New York, 1952, Chapter 2.

²D. C. McClelland, Community Development and the Nature of Human Motivation: Some Implications of Recent Research, paper presented to the Conference on Community Development and National Change, Center for International Studies, M.I.T., December, 1957.

³E. E. Hagen, An Analytical Model of the Transition to Economic Growth, Center for International Studies, M.I.T., 1957.

of capital formation."¹ This notwithstanding, it should be emphasized that it is real capital that makes possible higher productivity and higher national income (and consumption), so that our aim of increasing welfare can be materialized. The relation of low level output to low level capital stock in all the under-developed countries is too obvious to need elaboration. Without some increase in the stock of capital, other factors of production are seldom possible. Once the process of development gets started--as many under-developed countries today do--it is the rate of capital accumulation that chiefly determines the rate of increase of output which our welfare concept embodies.

Now, real capital² or capital stock increases by investment (in net sense) and more investment necessitates more saving, that is, capital.³ In almost every under-developed country of today, the most nearly omnipresent limiting and severe factor is saving or capital. This being the case, our discussion of investment criteria will be focused on how to make optimal use of this omnipresent

¹P. T. Bauer and B. S. Yamey, Economics of Under-developed Countries, Chicago University Press, Chicago, 1957, pp. 127-128.

²That is, the different types of tangible reproducible assets in the form of productive facilities, equipment, and reserves. The intangible capital stock--e.g., knowledge, training--are not included.

³This means capital as a homogeneous factor of production before it is invested; i.e., in monetary (liquid) form.

scarce factor. The problem can be stated either as a minimization of capital given a target increase in national product, or as a maximization of national product given the available capital. This is the simplified overall aspect. However, there is the actual composition of investment. Once capital is invested in various sectors of the economy, it ceases to be a homogeneous factor of production. It is embodied in reproducible assets of various forms and uses, differing in their speciality and durability and differing in their contribution to national product and in their impact on other aspects of development--such as technology, employment, saving, etc.--which are also very important. It is different emphases on these various aspects of investment that have caused many controversial issues both in theoretical discussion and in development programming.

In this sense, therefore, "minimization of capital" should not mislead us to undertake only those investments that require the least amount of capital. First of all, there is the requirement of proper sectoral balance as revealed by input-output analysis. Besides, different sectors have different capital coefficients in their production function. Although such coefficients are not fixed except in rare cases, their general magnitude is different from one sector to another. Minimization of capital

makes much more sense in regard to the selection of alternative projects within a sector than the selection of sectors. The latter is to be determined by (1) the possible pattern and structure of the economy in the future; (2) the factor supply conditions (including again capital); (3) inter-sector input requirements. If minimum capital is taken to mean least capital for a given income increase, then only the sector (or sectors) with lowest capital coefficient will be invested, while higher capital coefficient sectors-- usually the dynamic and modern sectors which have much greater impact on further development--will be excluded. This would tend to minimize the rate of development over time. A hypothetical example may serve to illustrate this.

Suppose the economy consists of 4 sectors: (1) Modernized investment goods industries; (2) Modernized consumer goods industries; (3) Agriculture and non-modernized consumer goods industries; and (4) Service industries. For each \$1 million increase in income, the capital and labor required by each sector is as follows:

Table 1.1. Parameters of Capital and Labor
per \$1 million Increase in Income

Sector	Capital (in \$ millions)	Labor (in man-years)
1	5.00	250
2	2.86	327
3	0.80	320
4	2.22	593

The above table assumes fixed capital and labor coefficients for each sector, which, of course, is not necessary. Now, given the total capital available at \$5 billion and total labor at 1 million man-years, the units of income increase (expressed in \$1 billion per unit) that can be achieved by each sector is shown in the following graph:

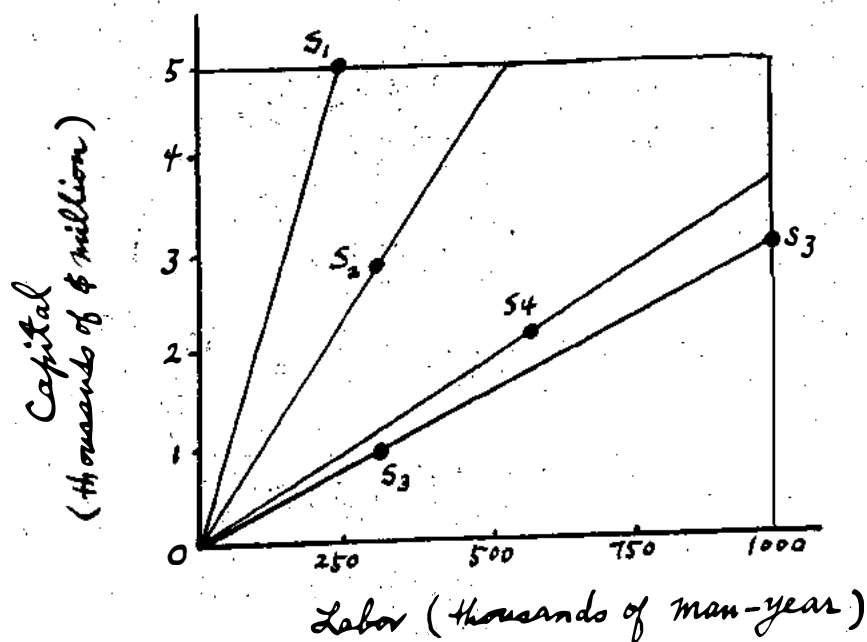


Figure 1.1. Units of Income Increase (in billion dollars)

Evidently it is Sector 3 that maximizes income increase with the given amount of labor and less than the given amount of capital. If investment is concentrated in it, then the amount of capital needed would be the least. Now, even allowing that this sector needs no additional inputs from other sectors, there are other considerations. The possible

savings from this sector is understandably very small, if any. Although present income can be maximized, this investment can not generate savings for reinvestment. Over time, income is not maximized. Moreover, in countries with low land/population ratios, this rather high income increase will soon reach a point where further investment in agriculture would bring practically nothing. And the economy will remain structurally unchanged, with a very low level of capital stock.

Which sector(s) to invest and, where different methods of production are available (i.e., different combinations of input and capital coefficients), what technology to be adopted? This is indeed one of the most crucial problems in economic development.

Historically, in the economic development of Western Europe and the United States, the price mechanism in a competitive market offered the best guide to investment decisions that resulted in the maximization of total product. Through sufficient knowledge, mobility, and flexibility, the price mechanism brought about equality between demand and supply, between price and cost, and equal return to capital in all lines of production. It was a gradual, spontaneous process of development under favorable factor proportion conditions. Today, in under-developed countries there exist serious structural disequilibrium, price

inelasticities, over-population, and a strong desire to "develop it quick" with very limited developed resources. With market conditions far from being able to offer a guide, some criterion for investment decision should be worked out to take the place of the automatic, market-price mechanism.

There are several kinds of approaches to this problem. The "intangible" criterion would be one based on intuition, sense of prestige, international demonstration, or just arbitrariness, as evidenced by insistence on steel industry, multi-purpose hydro-electric dams, or luxurious consumers' goods. The theoretical approach would broadly point out the direction of investment in terms of balanced growth or skewed investment in "strategic" sectors or industries. The criterion employed, such as the total linkage effect,¹ the per capita reinvestment quotient,² is still partial in nature and does not provide an overall, consistent program of development.

It is from considerations of the inter-industry relationships and the consistency and efficiency of the entire development program that some economists have attempted to

¹A. O. Hirschman, The Strategy of Economic Development, Yale University Press, New Haven, 1959, Chapter 6.

²W. Galenson and H. Leibenstein, "Investment Criteria, Productivity, and Economic Development," The Quarterly Journal of Economics, August, 1955, pp. 343-370.

work out a social price mechanism as a guide to resource allocation. The criterion of social marginal productivity (SMP) and the device of accounting prices as developed by Chenery¹ and Tinbergen² represents an approach of this kind. It defines investment criteria in the context of overall programming so that consistency and efficiency can be assured.

Insofar as quantitative formulations are concerned, the discussion in this paper will largely follow the line of this approach, although in the qualitative evaluation of aggregate and sectoral growth the theoretical approach will also be given proper weight. For, in the projection of aggregate growth and available resources, human decisions about the rate of growth would certainly play an important role: the (domestic) savings to be achieved depend as much on government ability to "force" out savings from the people as on people's willingness to sacrifice the present for the future. Likewise, the determination of the composition of output to be provided by various sectors should be based not only on statistical projections but also on

¹H. B. Chenery, "The Application of Investment Criteria," The Quarterly Journal of Economics, February, 1953, pp. 76-96.

²J. Tinbergen, The Design of Development, The Johns Hopkins Press, Baltimore, 1958, pp. 39-41, 76-78.

some hypothesis about the desired rate of growth of certain priority sectors.¹ The hypothesis about priority sectors, or investment decision at the sector level, should be made in the light of the possible future structure and pattern of the economy as conditioned by its resources, population growth, foreign trade relations, etc.

Different hypotheses about sector growth rates--taking into account both statistical trends and desired targets--will result in different projections of the final demand for each product. Given the final demand, the choice of investment projects within each sector will be made on the basis of social marginal productivity (SMP) calculated at accounting prices. Projects with highest SMP will be selected. Then, the level of domestic production will be determined and will be reconciled with the available factor supplies. This, in turn, may necessitate revisions of the target rate of growth, demand projections, and production methods.

The whole process, while providing a consistent framework for investment determination at sectoral and project level, requires detailed estimates, projections, and trial work. Aside from lack of highly technical data to base such estimates and projections in under-developed countries, the

¹For example, the modern industrial sectors, the economic overhead, etc. These are the so-called "development" sectors.

taking account of all interrelationships simultaneously is by itself a tremendous work. And, by using the accounting prices, there is the danger of leaving no market forces at work to reduce or eliminate the structural disequilibrium in the long run.

It should be pointed out that any theory about investment criteria is, in principle, "erroneous since modern welfare economics has shown the impossibility of constructing an adequate social welfare function."¹ Even when "welfare" is represented by national product, any theory about investment criteria is still necessarily incomplete and, therefore, may be irrelevant. For there are many immeasurable aspects of an investment (cultural, defense, etc.). There are also aspects which should be included but are very difficult to measure: the indirect and secondary consequences of an investment such as the Leontief coefficients, the external economies, the effects of changes in relative prices, etc. All these may require more elements of insight and wisdom than formal criteria.

As a matter of fact, for most of the under-developed countries, sectoral priorities are often determined in broad

¹J. Tinbergen, "The Relevance of Theoretical Criteria in the Selection of Investment Plans," in Investment Criteria and Economic Growth, papers presented at a conference sponsored jointly by The Center for International Studies and The Social Science Research Council on October 15-17, 1954, compiled by the Center of International Studies, M.I.T., Cambridge, Mass., December, 1955, p. 15.

terms of certain national objectives and bottleneck necessities. Likewise, in the selection of individual projects, usually only primary benefits and costs are calculated and are based on market prices rather than social prices.

It is always difficult to deal with the problem of investment criteria. The discussion that follows will necessarily be limited in scope and simplified in form. It will consist of four parts, viz. (1) The market environment and investment criteria; (2) Some theoretical issues on investment criteria; (3) Investment criteria in the context of development programming, with an appendix on various formulations of investment criteria for individual projects; and (4) Some national experiences.

II. THE MARKET ENVIRONMENT AND INVESTMENT CRITERIA

1. Investment determination under perfect competition: The Marginal Principle.

In a private enterprise society where competition of the various market forces is perfect or nearly so--i.e., complete knowledge, free entry, free mobility--numerous independent entrepreneurs make investment decisions guided by profit incentive. Motivated by this incentive, capital will flow to those uses where it can earn the highest rate of return until, on the margin, return from one unit of capital invested is the same in all uses and is equal to interest charge. In other words, the allocation of capital (and other factors as well) between and within different sectors would be up to that point where the returns from, or net productivity of, the marginal unit employed in each of the different uses are equal or nearly equal. If this is not so, then it is profitable to shift capital from sectors or uses where its marginal productivity is low to where it is higher. It is when the marginal productivity of capital in its various uses is equal that no further change is profitable and national product is at maximum. And, in equilibrium, the marginal return or productivity of capital in value terms

(i.e., marginal value product) should be at a level equal to the price paid to capital (interest rate).

This is the marginal principle which can be illustrated with a simple diagram. For any investment project, if more capital is employed in combination with given amounts of labor and land, then beyond a certain point, the resulting increments of product from equal increments of capital will start to fall off. Measuring the amount of capital invested on the horizontal axis (each unit, say, represents \$100) and the productivity or returns from successive increments of capital on the vertical axis, we have the following:

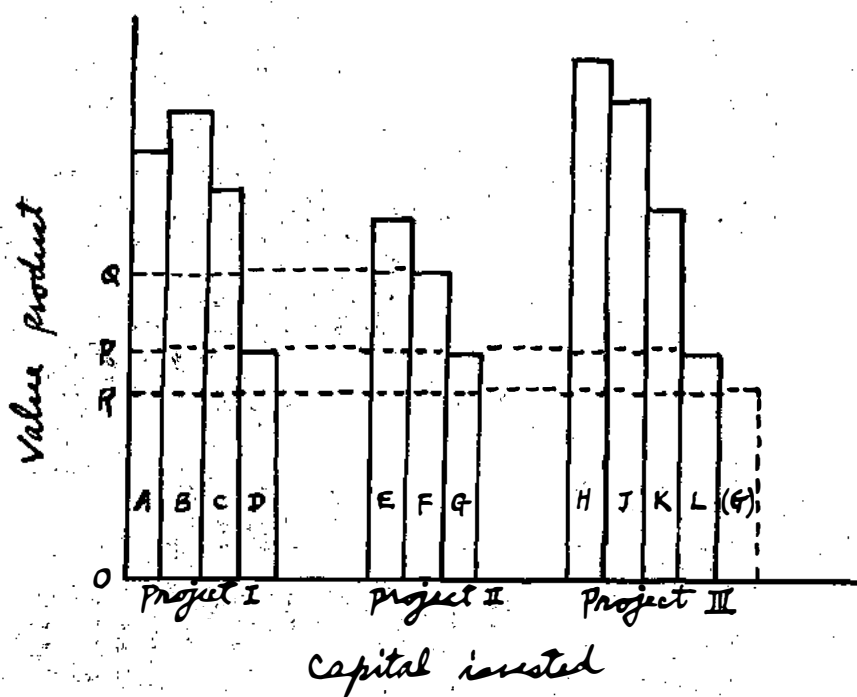


Figure 2.1. Marginal Productivity of Capital

The aggregate product of the three projects will be the greatest when the marginal productivity of capital in each project is equal, or D, G, and L are all equal to OP in the diagram. If the marginal unit originally invested in project II was shifted to project III, then the community would have lost OP worth of product in project II and gained a smaller value product OR in project III.

2. Limitations of the Marginal Principle.

Now, even under perfect competition, the marginal principle does not constitute an all-useful guide for allocation of resources from the social point of view. Aside from non-market factors such as government and defense programs, there are certain cases where market mechanism, if left alone, would not achieve maximum national product or social product.

The most important evidence is the difference between private marginal productivity and social marginal productivity. The former is the return to the private entrepreneur on the marginal unit of capital invested while the latter is that to the society at large. Many investments of great value to society would not have been undertaken at all, or undertaken only inadequately, from the point of view of private investors: their returns to private investors are small because some of the benefits from such investments to the society are unaccounted for by market valuations.

This is the case of external economies. Social overhead facilities (e.g., power, transportation, irrigation) as well as the non-pecuniary benefits from education, public health, and production research are of this category. Because of the difference, government has come to interfere in the form of public operation, subsidy, patent rights, or other encouragement measures.

On the other hand, there are investments the returns from which are attractive to private investors; but from the social point of view, the returns would be much less. This is the case of external diseconomies. An investment of \$100 may bring to the entrepreneur a net return (or income) of \$10. This is the private marginal product. But if it causes a \$3 loss to others (e.g., the higher laundry bills due to factory smoke), then its social marginal product is only \$7. Yet under the market mechanism, the competitive firm will invest the capital if its cost is \$10 or less. Such investments therefore are to be discouraged through tax measures or government restrictions.

Moreover, there are investments whose profits grow only slowly and whose risk is big from the private point of view, and they are therefore not undertaken by private entrepreneurs. But from the social point of view, the time preference premium and the risk premium as charged by private entrepreneurs are unduly great and should be in some way corrected by

public measures so that they can be undertaken. Here we have the famous case of infant industries. Despite the initial unprofitability due to large inputs and small outputs, profitable returns from such investments will start developing after a certain period of time. This delayed profitability¹ can be realized simply because the market gradually will expand which will enable the investing firms to exploit fully the economies of scale (the so-called internal economies). And along with this, there will be the development of complementary lines of activity and the general technological and organizational progress--the so-called spread effects which again are the benefits unaccounted for by market valuations.

But from the viewpoint of the private investor, whether this delayed profitability can be realized or not is a matter of great risk: the risk of future market demands and the risk of not having complementary lines of activity developed in time. Consideration of these risks would give rise to greater time-preference and risk premia. However, from the viewpoint of the society or the country, if such investments of slow maturity are not undertaken (and infant industries are necessarily slow maturing because they start

¹See William Fellner, "Individual Investment Projects in Growing Economies," in Investment Criteria and Economic Growth, Center for International Studies, M.I.T., 1955, pp. 125-130.

from almost nothing and usually involve time-consuming process) industrialization, economy of scale, complementarities, and all the accompanying technological and organizational progress may never happen. Therefore, the government has to devise measures to compensate or correct such unduly great premia. These include lower interest rate and tax allowances to increase the profit margin, subsidies on overhead facilities or on complementary industries to reduce the risk, and tariffs to ensure market. They involve sacrifices on the part of the present generation and the sacrifices are justified provided the burden of sacrifices made for the interest of future generations is distributed in a reasonable way among members of the present generation.

The above is the time factor which has to be taken into account. In the short run, marginal productivity depends upon the cost and price relations as determined by the existing demand and supply conditions; but in the long run, marginal productivity may be much higher because of the favorable demand and supply conditions made possible by investments now undertaken. However, there is also the magnitude factor in the marginal principle. Some investment, like gold extraction, has to be undertaken at a required minimum scale if there is to be any production at all. Therefore, the marginal productivity of capital in various uses is not exactly equal. Besides, the

thinning out of a small amount of capital among many uses would bring little or no return, while concentrating a substantial amount of capital on a specific industry and applying more productive techniques may result in good return. This foreshadows the ideas of lumpiness of capital and industrial nuclei of which more will be said in the next chapter.

3. Conditions in under-developed countries.

If the marginal principle under competitive market has such defects, it is the more difficult for under-developed countries to apply it as the guide to investment decisions.

On the static scene, the market in such countries is far from perfect competition. Of course, all actual economies depart from the idealized competitive conditions to some extent, but it is more so in almost all respects with the under-developed economies. Knowledge about the market is inadequate, there is no free entry and mobility. Because of these, marginal productivity of capital (and of other factors) is precluded from being equal in all uses and there is no way of finding out which is the marginal productivity to be used as the basis for factor price determination. In fact, market prices of factors do not represent their marginal value product or "intrinsic values;" rather, they are more influenced by social factors or government policies. This is the so-called "fundamental or structural disequilibrium" in the sense that productive factors are not used

in the proportions in which they are available. The fact that a number of factor prices are not in equilibrium can best be shown by the following phenomena in under-developed countries: at existing (cheap credit) interest rates, there is always a deficiency of investment funds; at the official (controlled) exchange rates, there is always an unsatisfied demand for foreign exchange; at the prevailing (trade union influenced) money wages, there is an over-supply of labor or widespread unemployment. This is true also of product prices where over- or under-valued factors of production are involved (e.g., high capital or high foreign exchange content commodities usually will be under-valued) or where government control or monopoly prevails (e.g., price fixing).

Under these circumstances, prices cease to be reliable parameters for making investment choice and there is no sense talking about allocation of capital (and other factors as well) in terms of marginal productivity (or marginal value product) calculated at the existing market prices.

On the dynamic scene, the changes in under-developed countries are often non-marginal and discontinuous in the sense that investment in one or two new plants may double or triple production of a given commodity where they would only constitute a marginal increase in an industrialized country. This means that even if there is no market

dis-equilibrium at the start of investment and market prices do not deviate from their "intrinsic values," the realization of the non-marginal investment would greatly change these values and would make the market prices deviating again. From the viewpoint of private investors, this means greater uncertainty and risk, and they may, therefore, devote their resources to less productive uses. Here again, the infant-industry case as stated before is applicable.

Even the device of accounting prices is very difficult to apply in this regard, because it is very difficult to ascertain the "intrinsic values" after the investment. Thus, for practical purposes, it may be quite sufficient to make a rough guess as to the consequences of fundamental dis-equilibrium only and to make the accounting prices independent of the size of the investment pattern.¹

4. The Need for Criteria and the Approach.

The developing countries of today are all confronted with the problem of capital scarcity. Their existing capital is relatively small compared to other resources, and it is difficult for them to abstain from consumption in order to accumulate capital stock. On the other hand, their population growth, especially in the Asian countries, has approached a point of explosion, which means that development

¹J. Tinbergen, The Design of Development, The Johns Hopkins Press, Baltimore, 1958, pp. 40-42.

should not only be undertaken, but undertaken with quick pace and substantial magnitude.

These two requirements--economize the use of capital and quicken the pace of development--necessitates the developing countries to deliberately weigh their investment decisions. The cost of an erroneous investment decision is relatively much higher in these countries because of the greater scarcity of capital, and because the time is urgent. What, then, should the criterion be?

From the foregoing, it is clear that the marginal productivity principle based on market prices is of no great help. Emphasizing the dynamic aspect of development, one approach to the problem of investment criteria considers development more important than the mere economization of capital. Without undertaking strategic investments to force out growth, economization of capital on marginal principle basis alone would fail to produce an impact large enough to enable the economy to take off.¹ This is a matter of development strategy. Thus, in the words of Higgins:

Misallocation a la marginal calculus is not only quantitatively unimportant, but is very nearly irrelevant to the development problem
Drastic structural change, involving wholesale transfers of population from peasant agriculture

¹W. W. Rostow, "Take-off into Self-sustained Growth," The Economic Journal, March, 1956.

to industry, which market forces alone and unaided will not produce . . .¹

What, then, are the strategic investments that help most to development? Again,

If we are concerned with the design of investment programs absorbing ten to fifteen per cent of national income, marginal returns to individual investment projects, taken by themselves, are unimportant The question is not "Which project by itself will bring the biggest increase in output, relative to cost, during the next few years?", but "Which pattern and sequence of projects during the next five years will bring the most rapid growth of national income during the crucial period--say, in the decade beginning ten years hence?" This question breaks down into such hard-to-answer sub-questions as "What investment program will have the maximum aggregate linkage, backwards and forward?" What kinds of investment will create pressure of a kind that will assure the undertaking of further investment? Which will bring the most improvement in labor, managerial, and technical skills? Which will contribute most to technology-mindedness and development-mindedness? Which will do most to shift entrepreneurs from "zero-sum games" to "positive-sum games"?²

Another approach is the attempt to quantify investment decisions and to put it again on a marginal principle basis by using accounting prices instead of market prices. The accounting prices are the prices representing the true or

¹B. Higgins, Comments on A. C. Harberger, "On Making the Most of the Available Resources," paper presented at the Chicago meeting of the Joint Allied Social Science Associations, December 27, 1958, Center for International Studies, M.I.T., p. 2. (mimeographed).

²Ibid., pp. 5-6.

intrinsic values of the factors or products in question: prices at which supply is just sufficient to satisfy demand. They are to be determined in the context of the development program in which levels of production, scarce factor supplies, and final demands are consistent so that the system is in general equilibrium.

The first approach emphasizes where the investment should be made and what its magnitude should be. Here, some economists advocated an all-out big push or a minimum initial effort in order to get the economy over the hump. Others stressed that investment should be made in those industries (implying modern, capital-intensive industries) where additional investment can be induced out easily and the "linkage effects" are large or where the per capita re-investment quotient can be maximized through higher marginal savings rate and slower population growth. The second approach views the problem not in terms of theoretical "should," but in the context of development programming with empirical projections. It takes into account the inter-sectoral balance and scarce factor supplies and uses such devices as accounting prices, input-output tables, and the social marginal productivity criterion.

Both of these approaches have their special relevance and significance to the whole problem of investment criteria and economic development, and are being applied in one way.

or another by developing countries today. It is quite beyond the scope of this paper to discuss them in all their aspects. Besides a brief review of some of the theoretical postulates, the main effort here is to show that the best guide for investment criteria and investment priorities would be a complete development program combining elements of aggregate growth, sectoral balance, and project selection. But insofar as development programming has to make projections of the "final bill of goods" on the basis of an estimated aggregate growth rate, the theoretical postulates will have much to say and to help in establishing hypotheses for such projections and estimations. In other words, they provide a good guide as to where to invest (sectors and industries). From such hypotheses, it is the work of programming to see whether the projections thus made can be realized and attained with minimum capital. If the resources required are not available, the hypothesis used has to be changed and the development program revised accordingly. And when a complete development program is impossible due to lack of statistical data, partial criteria for investment decisions at the project level will have to be used.

III. SOME THEORETICAL ISSUES ON INVESTMENT CRITERIA

1. Magnitude of Investment: The Minimum Effort Thesis.

There is no doubt that in order to have development, to get the economy taking off, the developing countries should have a sufficiently large rate of investment per year for a certain period so that per capita income can increase persistently and more and more additional savings can be generated to enable the economy to grow on its own. This involves the growth of population, income, and savings. It concerns not so much the problem of making the best use of a given investment as the problem of how big should the investment amount be as a required minimum for getting the economy off "dead center." To achieve this required minimum, either domestic savings should be greatly increased through forced measures, or foreign assistance should be extended in substantial amount and over a long period. Falling short of these, the economy will remain in a so-called quasi-equilibrium or subsistence equilibrium.

Thus, the Indian Planning Commission, in describing the foremost significant decisions underlying India's Second Five Year Plan (the world's greatest development plan under democracy), puts it very clearly:

The second Plan must be big--big enough and powerful enough to begin to lift the Indian economy across the threshold to a developed nation.

India feels that a massive plan with high targets is not a matter of choice but of necessity. The First Five Year Plan, while its gains were considerable, showed that modest effort cannot push the country forward far and fast enough. . . . It feels it cannot attempt less, under the intensive pressures of time, of a rapidly multiplying population, of rising popular demands, or under the external political pressures for swift development.¹

This minimum effort thesis has its many versions. Rosenstein-Rodan's "big push" theme² stresses external economies in terms of complementarities and indivisibilities. The indivisibility of capital supply, especially the supply of social overhead capital, usually requires a great minimum size (lumpiness of capital). The indivisibility of demand (complementarity of demand) requires simultaneous investment in many industries in order to support each others' market. Aside from this, there is the theory of income and population growth stressing the necessity of a minimum initial effort in order to get the economy out of the "low-level equilibrium trap." This theory is of special relevance and significance for Asian countries where population grows at a high rate and where land/population ratio is low.

¹ Government of India, Planning Commission, The New India: Progress Through Democracy, MacMillan, New York, 1958, p. 40.

² P. N. Rosenstein-Rodan, Notes on the Theory of the "Big Push", Center for International Studies, M.I.T., Cambridge, Mass., March, 1957.

At low level of per capita income, any small increase in per capita income (action) will be nullified by income-depressing forces (reaction), so that per capita income will return to the subsistence level.¹ The cumulative, self-enforcing forces generated by an increase in per capita income, as emphasized by Myrdal,² are prevented from bringing the economy progressively upward by these stronger self-reacting forces; therefore, there is "stability in the small." But with large increases in income (investment exceeding a certain minimum scale), per capita income will go on expanding toward sustained growth, and there is therefore no "stability in the large."

¹The reasons why small increase in per capita income will not yield steady growth are: (a) increased consumption by peasants and workers; (b) population increase; (c) investments take time to bear fruit; (d) positive-sum activities by entrepreneurs not encouraged and zero-sum activities not discouraged; (e) resistance to changes of old ideas, behavior, incentives, attitudes, etc. not overcome; (f) ICOR is large in the low income equilibrium and constitutes a hurdle. (See H. Leibenstein, Economic Backwardness and Economic Growth, McGraw-Hill, New York, 1957, Chapter 12). Higgins attributed the failure to yield sustained growth to population growth and such factors as: internal diseconomies of scale due to indivisibilities of factors of production, other indivisibilities with regard to investment decisions, and external diseconomies due to external interdependence. See B. Higgins, Economic Development, W. W. Norton, New York, 1959, pp. 393-394.

²Gunnar Myrdal, Economic Theory and Underdeveloped Regions, Gerald Duckworth, London, 1957, Chapter 2.

The so-called "low-level equilibrium population trap" may be shown in a graph as follows:¹

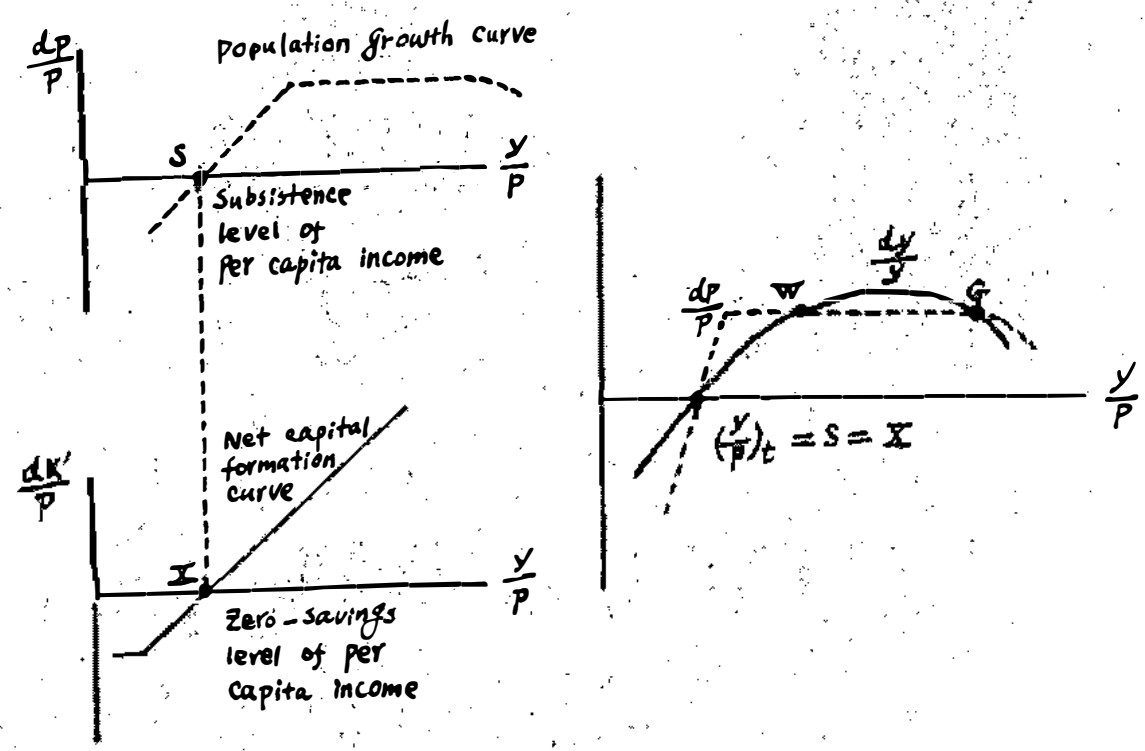


Figure 3.1. The Low-level Equilibrium Trap

The above population growth curve shows that in the short run, increase in per capita income will cause the death rate to decline, so population keeps growing until it reaches the "biological maximum" level after which the curve flattens out despite further increases in per capita

¹R. R. Nelson, "A Theory of the Low-Level Equilibrium Trap," The American Economic Review, December, 1956, pp. 894-902.

income. In the long run, the curve will slope downward because birth rate will go down while death rate remains stable.

The net capital formation curve represents savings-created capital invested in the industrial sector. There is a floor to dis-investment determined by technological factors. The point X (zero-savings level of per capita income) may or may not be the same as the point S (subsistence level of per capita income), depending on the state of income distribution. (The more equal the distribution, the more will the curve shift to the right; the less equal, the more to the left.)

The point T (trap) represents a stable equilibrium point because deviations from it in either direction will bring forth forces to work to its restoration. If a jump can be made to the point of W (which by itself is an unstable equilibrium point) and the pace is maintained, then another stable equilibrium point G at much higher per capita income level will be reached and the economy will have escaped the trap.

The size of "minimum effort" expressed in terms of annual rate of net investment (i.e., net investment as percentage of national income or product) is something of the order of 10%-15% as envisaged by both Leibenstein and Rostow. There are several problems connected with the optimality of

this rate. One is the value of ICOR which depends upon the sector(s) in which investments are to take place. Another is the danger of inflation once investment demand is made larger than actual savings. There are a good many instances in which the rate of capital formation is lower for countries with inflation than countries with stable prices.¹ There is also the problem of getting enough savings to support this rate of investment, which usually means sacrificing present consumption either voluntarily or through forced measures. Lastly, there is the rate of population growth. In Taiwan, for example, during the period of 1953-1968 it has experienced the high population growth rate of 3.7% per annum! A substantial increase of 32% in real national income during the same period brought about only an average annual increase of 2% in per capita income.² Here it is evident that a positive population policy is as important as a higher investment rate.

It is clear from the above that the minimum required rate of investment depends upon the conditions of the particular country in question, especially its population growth

¹ See, for example, U.S. Senate, Committee on Foreign Relations, Problems of Latin American Economic Development, Study No. 6 (prepared by University of Oregon Institute of International Studies and Overseas Adm.), 86th Congress, 2nd Session, Washington, D.C., February 11, 1960, pp. 90-91.

² See Industry of Free China, Vol. XIII, No. 2, February, 1960, pp. 48-51.

and direction of investment. But in any case, it should be such as to sustain the increase in per capita income. It is not necessary, and often not possible, to attain a high rate of investment in a single jump. It would be more compatible with the capabilities of under-developed countries to make the jump in stages. In this regard, India's development plan may serve as an illustration. The rate of investment was 5% in 1950, raised to 7% at the end of First Plan (1955), and is expected to rise to 11% at the end of Second Plan (1960), 14% in 1965, and 16-17% in 1970 and after. With both low ICOR (1.8) and population growth (averagely 1.3% per annum) during the First Plan period, an average annual investment rate of 6% has brought about 2% increase in national income per capita per annum. The Second Plan aims at increasing national income by 25%, or 5% per annum on the average. With population now growing at about the projected rate of 1.9%, this would mean an average per capita income increase of 3% per annum. Already there have been indications that the Second Plan can hardly be fully carried out without outside aid. There have been price inflation, a large deficit in the balance of payments, and inadequate domestic savings.¹ Here is a fact that even "jump in stages" is no easy task. This means that there

¹See N. A. Sarma, "Economic Development in India: The First and Second Five Year Plans," IMF Staff Papers, April, 1958.

always is a distance between "think big" and "act big," and that foreign aid is absolutely necessary for really poor countries to achieve sustained growth.

2. Simultaneous Action and Balanced Growth.

The question of where the capital should be invested has always been a highly controversial one. Some economists emphasized the complementarity aspects of investment and came up with the prescription of balanced investment. Others sought for dynamic factors that have crucial influence over development as a continuous and self-enforcing process, and stressed unbalanced or skewed course. Both are relevant in the investment decision. Because on the one hand, a proper balance is needed if the present development program is to be physically carried out. On the other hand, development programs themselves are based on projections and estimates which should take into account those dynamic forces if the economy is to have structural change and sustained growth. Before attempting to elaborate this in terms of development programming in the next chapter, we need first to give a brief description of some of the theoretical issues concerned with balanced and skewed investment.

The idea of "balance" among sectors or industries is itself subject to many explanations. Here we mean a simultaneous action on all related fields (sectors or industries) as necessitated by technical complementarities on the supply

side and market complementarities on the demand side. The balance in supply emphasized complementarities and external economies among various sectors of the economy: that they should grow in some (properly balanced) proportion so that no one would get too far out of line to cause supply difficulties.¹ Thus, industry must not get too far ahead of agriculture, lest food and raw material inputs needed by industrial workers and machines would be in shortage. Social overhead capital (power, transport and communications, water supply, housing) should be adequately developed to support and stimulate the growth of other directly productive industries. And if some of the required inputs have to be imported, an increase in exports is necessary.

Insofar as technical production process is concerned, the need for balance on the supply side is evident as shown by modern input-output analysis, especially for modern sectors where inter-industry relationships are high. Viewed in this respect, the problem is not balance or no balance, but balance at what level of production and which kind of technology. And if there is substantial foreign trade, balance need not take the form of internal balance.

¹This is the relatively rigid kind of complementarity via production process (derived demand). There is a looser "developmental" type of complementarity (entrained want) where increased use of A induces an increased demand for B. See A. O. Hirschman, The Strategy of Economic Development, pp. 67-69.

Balance in demand--market complementarities--was first given proper emphasis by Rosenstein-Rodan in his original article of "Problems of Industrialization of Eastern and South-Eastern Europe,"¹ and later given wider publicity by Ragnar Nurkse.² By the use of the now famous shoe factory example, it was argued that an individual investment venture has high risk and is likely to turn into a failure because its product will not find a market large enough to absorb it. "An increase in the production of shoes alone does not create its own demand."³ Here Say's law is not applicable. The risk of not finding a market reduces the incentive to invest, and the project will be abandoned. The easily saturated market means an inelastic demand which is the result of low level of real income due to low level of productivity. To break this kind of "vicious circle," we need an overall enlargement of the market by synchronized application of capital to a wide range of industries which will then be each other's clients through the purchases of their workers, employees, and owners. "Balanced growth may be a good thing for its own sake, but here it interests us mainly for the sake of its effects on the demand for capital. It . . .

¹The Economic Journal, June-September, 1943, p. 205.

²R. Nurkse, Problems of Capital Formation in Underdeveloped Countries, Oxford University Press, New York, 1953, Chapter I.

³Ibid., p. 12.

[Is] an essential means of enlarging the size of the market and of creating inducements to invest."¹ According to Nurkse, this demand aspect of the problem of capital formation is not so troublesome as capital supply from the viewpoint of practical policy. For deficiency in the demand for capital is true only from the viewpoint of private businessmen, not from the standpoint of the economy as a whole. This means that balance in demand can be achieved through deliberate measures of organization (central planning), encouragement to private entrepreneurs, and public investment. And this is also what the developing countries are doing today with their development plan of one kind or another.

There is of course much to be said about the feasibility of this balanced investment approach. First, in the actual world, development has not proceeded in a manner in which every activity expands perfectly in step with every other. On the contrary, the actual development path consists rather of a series of uneven advances of one sector (the leading sector) followed by the catching-up of other sectors (the followers). Secondly, this simultaneous big push presupposes an amount of resources and an ability to utilize such resources which is quite beyond the reach of the under-developed

¹Ibid.

countries. Whereas the relationship between industries is for the most part complementary, the limitation of factor supply assures that the relationship is for the most part competitive. Balanced investment would result in a thinning out of capital among various sectors of the economy, with the impact of each investment not strong enough to cause structural change or sustained growth. It is not only unattainable in most under-developed countries, it is even undesirable. The best way to provide a big push to get an under-developed economy off dead center and onto sustained growth is to concentrate investment in those "strategic" sectors or industries that generate forces for further investments.

Explanations have differed as to how such further investments are made possible. But they do seem to agree that it is by investing in modern, capital-intensive sectors that generation of additional investment can be best assured. Initial investment in such strategical sectors will either produce favorable effects upon the supply of the entrepreneurship and savings and population growth, so that over time there will be a higher rate of reinvestment from the product of initial investment (the ploughing back of profits); or it will induce a chain of related investments through inter-industry linkage mechanism, so that development-promoting forces would spread over the entire economy in a

wave-like manner. These are the two major explanations to which we will now turn.

3. Modern, capital-intensive Industries and Reinvestment Rate.

If capital is to be thinning out among various uses as balanced investment should suggest, it implies that the allocation of capital has to be based somehow on the marginal productivity principle and the production method to be adopted would be labor-intensive rather than capital-intensive. The result would be more immediate employment, higher (present) total output, larger wage shares (in real terms) and smaller profits to business. Since it is labor who has the highest propensity to consume and it is business who has the highest propensity to save, this would lead to higher population growth (due to rising consumption and declining death rate) and less reinvestment. But it is exactly the rate of reinvestment that determines the rate of capital accumulation and the productive capacity of the economy. Maximum (present) total output or return per unit of investment may therefore be achieved at the expense of maximum total or per capita output in the future because of these implications of saving, reinvestment, and population growth.

Recognizing this, the objective of development should be the attaining of a level of economic capacity which maximizes output per capita at a determined future time (say 10 or 15 years hence). This is possible only when the

productive power per worker is maximized. To achieve this, we must maximize (a) the amount of capital per worker, and (b) the quality of the labor force, i.e., its skill, knowledge, energy and adaptability. Aside from human factors, maximum output per capita is to be achieved by maximizing capital/labor ratio which, over time, is determined by reinvestment and labor force (or population) increase. Thus we should maximize reinvestment and minimize population increase, and from these two considerations the criterion of "marginal per capita reinvestment quotient" was developed. If this quotient of capital is equal in its various uses (again a marginal principle), then allocation of capital would be at its best.¹

The investments that will bring forth the highest reinvestment quotient are those in modern, capital-intensive industries. Under the simplified assumption that output is divided between wages and profits, using less labor means smaller total wage bill and larger profits. Assuming further that wages are all consumed and profit all saved,

¹See W. Galenson and H. Leibenstein, "Investment Criteria, Productivity, and Economic Development," Quarterly Journal of Economics, August, 1955, p. 351. Compare also Leibenstein, Economic Backwardness and Economic Growth, p. 267, where investment criteria is said to be the maximization of (a) the marginal product of the given investment plus (b) the sum of all subsequent general reinvestment divided by the size of the population (i.e., the per capita reinvestment quotient) at the related time points. General reinvestment means that part of marginal product which is invested in physical capital and in human beings.

larger profits mean larger savings and reinvestment by profit recipients. This, in fact, is the way the private capitalistic economies accumulated their capital and is the secret to the rapid increase from 5% of income saved in a stagnant economy to 10-15% saved in a growing economy.¹ Besides widening the gap between output and consumption, investment in capital-intensive industries will promote urbanization at an optimal rate and, therefore, is conducive to the lowering of population growth.² This again will increase the reinvestment quotient and speed up capital accumulation.

The above is, of course, relevant to development as a spontaneous process in a private enterprise economy. In some of the under-developed countries of today, however, there are many problems which call for immediate solution. The presence of large unemployment is already a very serious problem which if not properly dealt with would endanger the very environment for development. The population situation is already at a dangerous point of explosion

¹See W. Arthur Lewis, The Theory of Economic Growth, Richard D. Irwin, Homewood, Illinois, 1955, pp. 253-236.

²Using less labor means minimizing the transfer of manpower from countryside to cities, this will lower the ratio of urbanization cost to output per worker and therefore maximize capital formation. This may not be the optimal rate of urbanization, but it certainly is closer to it than the maximum rate of labor absorption. See Galenson and Leibenstein, op. cit. pp. 360-361.

where a positive population policy is more needed than an investment policy based on the experiences of the West.¹ There is also the problem of striving for equality in income distribution.

The most important point is that, while capital-intensive industries would result in higher rate of savings and larger voluntary re-investment, there are still vast areas of activities which can meet the above urgent needs and at the same time can increase output without using much capital. These include the using of surplus labor for construction work, community development, agricultural and industrial improvements, etc. If saving (and consequently reinvestment) can be made out from these increased output through adequate policy measures (fiscal and monetary policy, pricing of public and utility enterprises, or even compulsory saving measures), then there is no reason why investment should be confined to capital-intensive sectors. In other words, investment policy is not the only thing--or even the most important thing--that affects rate of saving and reinvestment. Other policy measures can and should be applied to raise the rate of savings and reinvestment. Even the Soviet

¹See H. H. Villard, "Investment Criteria, Productivity, and Economic Development: Comment," The Quarterly Journal of Economics, August, 1957, pp. 470-471. Also compare H. T. Oshima, "Economic Growth and the Critical Minimum Effort," Economic Development and Cultural Change, University of Chicago, July, 1959, pp. 473-474.

experience (where the population was not explosive) has shown that it is capital productivity, not labor productivity, that is maximized. While the main production processes of the "growth" sectors in the priority area are carried out by capital-intensive methods, the auxiliary processes use labor-intensive methods as far as possible.¹

In short, an adequate investment program should contain both capital-intensive and labor-intensive undertakings in order to achieve greater total output and greater savings and reinvestment. The latter can be achieved through highly organized efforts and strong and crucial government measures,² as evidenced by Soviet Russia and Communist China's experience. Here lies the fundamental cause for the tendency for some under-developed countries to go the totalitarian way.

¹See David Granick, "Economic Development and Productivity Analysis: The Case of Soviet Metalworking," The Quarterly Journal of Economics, May, 1957, pp. 227-233.

²That is, to widen the difference between consumption and the total wage bill through restrictive measures or intervention as far as possible. But here the reinvestment is not "automatic" according to Leibenstein. In practice, inflation is often the more likely contingency than taxation in under-developed countries where a substantial portion of wage income is paid in kind and where people are living close to the margin of existence. See Galenson and Leibenstein, "Reply to Moes and Villard," The Quarterly Journal of Economics, August, 1957, p. 473.

4. Highly Interrelated Industries and Maximum Induced Investment.

The theory of skewed investment has another version besides the above one which stressed the "automatic" flow of savings and reinvestment. In its simplest form, it goes something like this: although all industries are basic in the sense of complementarities or external economies, they are definitely not equally basic. There are industries and sectors which have a higher degree of complementarity with each other or have greater external economies. It will therefore be more advantageous to concentrate a large proportion of newly available capital on the establishment of these industries as development nuclei or development blocks in the hope that they, consisting of a number of mutually sustaining projects, will constitute strategic growing points from which the impulse towards further investment and growth will spread to the rest of the economy. The spread is made possible through such dynamic forces as increased trained labor, expanded market and demand, improved managerial and technical skills, enhanced technology- and development-mindedness, and reduced uncertainty. All these, as a rule, are to be obtained from undertakings that use advanced and relatively capital-intensive technology.

More recently, the above has been developed into a theory of compulsive sequence and maximization of induced

decision making.¹ The problem of development is not the lack of savings (at least not so in the first stage of growth), but the lack of ability to channel savings into productive investment, i.e., lack of the ability to make and carry out development decisions. The real limiting factor in under-developed countries is the ability to invest.

To make the best use of this factor, development should be proceeded, not in a balanced or completely orderly fashion which would demand too much autonomous investment decisions, but in a disorderly and unbalanced fashion from which pressures and incentives are created and additional investments induced without calling for autonomous investment decisions. What is required is not balanced growth with its simultaneous attack on a broad front, but rather a sequential or chain solution containing disproportions and disequilibria that produces tensions, pressures and incentives, and therefore maximizes decision-making:

. . . the question of priority must be resolved on the basis of a comparative appraisal of the strength with which progress in one of these areas will induce progress in the other. In these basic types of development decisions, it is therefore not sufficient to supplement, qualify, and otherwise refine the usual investment criteria. We must evolve entirely new aids to thought and action in this largely uncharted territory of efficient sequences and optimal development strategies.²

¹A. O. Hirschman, Strategy of Economic Development, Chapter 5.

²Ibid., 79.

On the factual side, too, the industrialized countries did not get where they are through "balanced" growth. Actual development has proceeded in a seesaw manner, with growth being communicated from the leading sectors to the followers, from one industry to another, from one firm to another. "Observation tells us that rapid growth of countries, cities, industries, and individual firms hardly ever proceeds in a completely orderly fashion."¹ The crucial problem then is, if balanced investment and simultaneous action is impossible in under-developed countries because of the lack of ability to make investment decisions, what is the sequence of development action to be adopted?

The most efficient sequence should be one which produces optimal tensions, disproportions, and disequilibria² and therefore maximizes induced decision-making and additional investment and output. To explain this, Hirschman provides the following illustration:³

¹Ibid., p. 80.

²These should be of optimal degree because excessive disequilibria or disorderliness "may exert an inhibiting and demoralizing influence on further growth," see Hirschman, Strategy of Economic Development, p. 80; also p. 97.

³Ibid., 86-90.

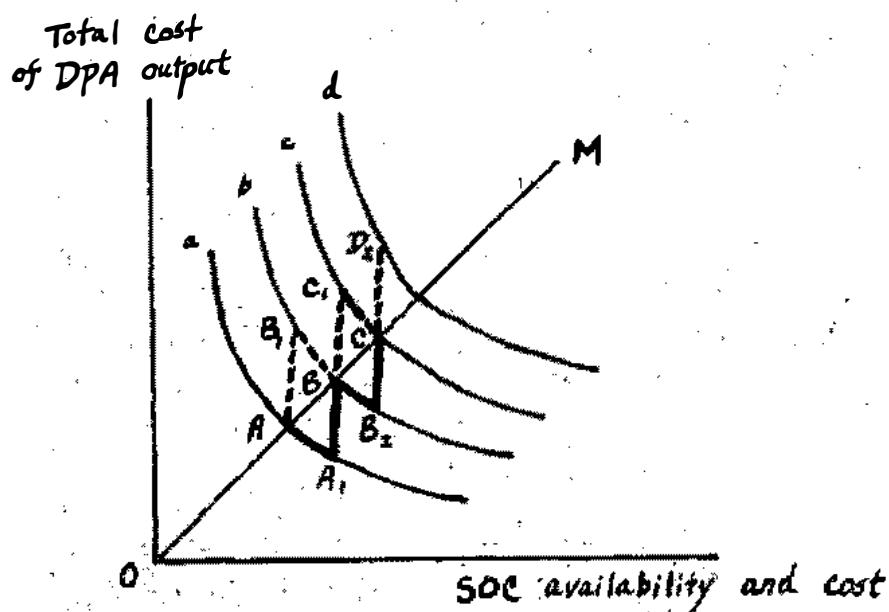


Figure 3.2. Balanced and Unbalanced Growth of DPA and SOC

For theoretical and practical usefulness, development activities may be divided into two categories: Social Overhead Capital (SOC) and Directly Productive Activities (DPA). The curves a, b, c, d in the above graph represent not exactly the usual isoquants, but cost curves at different levels of DPA output, i.e., cost of producing a given full-capacity output of DPA from a given DPA investment as a function of the availability of SOC. The line OM is the ideal expansion sequence representing balanced growth of DPA and SOC, with minimum cost at each level of DPA output. Since it is not possible to attain this ideal expansion sequence as explained above, the efficient sequence would be

either SOC lead (development via excess capacity of SOC) or DPA lead (development via shortage of SOC). The former sequence (A A₁ B B₂ C) will build up "incentives" to DPA investors and therefore induce additional investment, while the latter sequence (A B₁ B C₁ C) will produce strong "pressures" and therefore compel additional investment. The relative "efficiency" of each will depend on the strength of entrepreneurial motivations on the one hand and on the response to public pressure of the authorities responsible for SOC on the other. It will vary widely from region to region and from country to country.

Now, by applying this pressure and incentive sequence to directly productive activities themselves, we found two inducement mechanisms at work: (1) the input-provision (derived demand), or backward linkage effects, by virtue of which investment in earlier stages of production are encouraged or induced; (2) the output-utilization (catering to entrained wants), or forward linkage effects, by virtue of which investment in subsequent stages of production are encouraged or induced. The strategy of development calls for the selection of those industries or sectors that produce the greatest total linkage effects. Such linkage effects are not to be measured by the loose, general reference to the advantages of external economies, complementarities, cumulative causation, etc., but by empirical studies of the input-output statistics.

The results of a recent study by Chenery and Watanabe¹ may be used as an illustration:

Table 2.1. Average Degree of Interdependence of Economic Sectors in Italy, Japan, and United States

	Interdependence through purchases from other sectors ^a (<u>Backward Linkage</u>)	Interdependence through sales to other sectors ^b (<u>Forward Linkage</u>)
1. Intermediate Manufacture (backward and forward linkage both high)		
Iron and Steel	66	78
Nonferrous Metals	61	81
Paper and Products	57	78
Petroleum Products	65	68
Coal Products	65	67
Chemicals	60	69
Textiles	67	57
Rubber Products	51	48
Printing and Publishing	49	46
2. Final Manufacture (backward linkage high, forward linkage low)		
Grain Mill Products	89	42
Leather Products	66	37
Lumber and Wood Products	61	38
Apparel	69	12
Transport Equipment	60	20
Machinery	51	28
Nonmetallic Mineral Products	47	30
Processed Foods	61	15

¹H. B. Chenery and T. Watanabe, International Comparisons of the Structure of Production, paper presented at the Cleveland Meeting of the Econometric Society, December, 1956.

Shipbuilding	58	14
Miscellaneous Industries	43	20
3. Intermediate Primary Production (forward linkage high, backward linkage low)		
Metal Mining	21	93
Petroleum and Natural Gas	15	97
Coal Mining	23	87
Agriculture and Forestry	31	72
Electric Power	27	59
Nonmetallic Minerals	17	52
4. Final Primary Production (backward and forward linkage both low)		
Fishing	24	36
Transport	31	26
Services	19	34
Trade	16	17

a. Ratio of interindustry purchases to total production (%).

b. Ratio of interindustry sales to total demand (%).

Note: The above table is useful for economic planners in under-developed countries when the commodity composition of the under-developed country's output is expected to bear some resemblance to the average of these three countries on whose input-output statistics this table is based.

Source: H. B. Chenery and T. Watanabe, International Comparisons, p. 11.

On balance, it seems that industries having greater total linkage effects are those falling under the "intermediate" groups. Manufacturing is generally higher than primary production, especially in backward linkage effect which is considered more important to industrial development because of its strong "pressure of demand." This inducement mechanism

of linkage effects, together with another inducement mechanism in which complicated technology and machine-paced operations compel quality and maintenance by the individual firm,¹ points again to the theme of priority for those industries using advanced and relatively capital-intensive technology.

From all the foregoing, we can see that while other writers stressed the development of highly interrelated industries because of the considerations of external economies or technical complementarities, Hirschman has utilized these interrelations to develop a strategy of optimal disorderliness or imbalance (the "efficient" sequence of expansion) to generate an inducement mechanism which will induce or compel additional investments by reducing uncertainty and making investment decisions easier. This fits in well with his thinking that the basic limiting factor is the lack of ability to invest, that inducement mechanism is necessary to economize the use of this factor on the one hand and to maximize further investment and growth on the other. It "leads to a theory of development which is more applied psychology than economics . . . capital and other input limitations are [considered]

¹These refer to petroleum refining, airlines, etc. See Hirschman, op. cit., Chapter 8.

illusory, the economist is left with nothing to economize except the elusive quality of decision-making."¹

It is clear that this theory pre-supposes a predominantly private enterprise economy, with numerous independent entrepreneurs lacking the ability to make investment decisions. In fact, under-developed but developing countries of today are all put under some sort of state planning with the state playing a major entrepreneurial role. This is mainly because they are aware of the lack of this ability on the private part and because they understand the indivisibility in the investment decision-making process as revealed by modern economic analysis.² The "demand" is there, and no matter on which basis it is planned (balanced or skewed), it is always made big enough to match the strong desire for quick development. Hirschman certainly understates the role and magnitude of state planning in investment. If, by following his strategy (the emphasis by under-developed countries on iron and steel which has the highest combined

¹Comment by H. B. Chenery, in The American Economic Review, December, 1959, p. 1064.

²"The basic reason for government action to promote development is that each of a set of individual private investment decisions may seem unattractive in itself, whereas a large-scale investment program undertaken as a unit may yield substantial increases in national income." See B. Higgins, Economic Development, p. 387. See also Nurkse, op. cit. p. 30.

linkage effects may be a case in point), numerous additional investments are "induced," how then are the responsible authorities to provide foreign exchange, saving, skilled labor, technicians, etc. for such investments? To Hirschman, this shortage in supply will not happen in the "first stage" of growth. But this is certainly not the case with the large-scale planned investment in today's developing countries. Therefore, the problem is again one of supply, especially supply of capital, as well said by Nurkse.¹ Our task then is to reconcile the investment demand and available resources. This cannot be determined a priori, but has to be determined in the process of programming.

The following chapter will describe investment criteria chiefly in terms of development programming as elaborated by Tinbergen and Chenery and to some extent applied by the Latin American countries in recent years.² The model used will be a simple one and the method employed will be pragmatic rather than highly mathematical.

¹Nurkse, op. cit. pp. 30-31.

²See United Nations, ECLA, Analyses and Projections of Economic Development, I. An Introduction to the Techniques of Programming, New York, 1955. See also United Nations, ECLA, Analyses and Projections of Economic Development, II. The Economic Development of Brazil, New York, 1956; III. The Economic Development of Colombia, New York, 1957.

IV. INVESTMENT CRITERIA IN THE CONTEXT OF DEVELOPMENT PROGRAMMING

1. The Nature of Development Programming.

By development programming we mean a systematic and consistent analysis that provides a basis for designing and carrying out development policy. Development policy is concerned with the rate of growth and the future structure or pattern of the economy as determined by the supply and allocation of investment funds (domestic saving and foreign investment), foreign exchange, and other scarce resources. It is the task of programming to try to establish a set of figures that satisfy the requirements of these processes.

Development policy is different from stabilization policies which aim at preventing short-run fluctuations in prices, employment and trade. However, the requirements of stabilization limit the alternatives available for development policy by putting restrictions on the total investment, the balance of payments, and allowable demands for other resources. It is within these limits that development policy tries to achieve various long-term objectives, of which maximum national income per capita over time is the most important.

The nature and extent of development programming depends on several factors: the stage of planning already reached, the availability of data, and the programming techniques used. Generally, there are three types of programming:

a. Programming at aggregate level--This consists mainly of national accounts analyses and projections of other magnitudes such as industrial production, labor force, average labor productivity, balance of payments, etc. It provides a fairly adequate basis for the use of general policy instruments, but cannot furnish a check on the consistency of different sectors nor on the balance of payments. It is more likely to be adequate when the composition of production and consumption does not change too much as income increases and when market mechanism works well.

b. Programming at sector level--This consists of analyses of the demands and investment prospects in individual branches of production. Its main function is to determine the relative priority of investments within the sector. In the initial stage of planning, investment program for the whole economy (or the government-controlled portion) usually consists of high priority projects in each sector. This approach, taking each sector by itself and neglecting intersectoral relations, does not provide a test of consistency of decisions made in each sector, nor a way of comparing high priority projects of one sector with those of another.

But in primary-producing economies where sectoral interdependence is not so great as in industrialized economies, these defects are less serious.

c. Over-all programming--This combines the elements of both aggregate and sector programming in varying degrees, but they must be reconciled in their final result. The necessity for overall programming arises from the inconsistencies in demand and resources supply as experienced by many under-developed countries (large balance of payments deficits, unemployment, input bottlenecks, or regional imbalance). An overall program usually consists of three processes: Project Analysis, Sector Analysis, and Aggregate Analysis. Project analysis is essentially a process of preparing technological information for producing a given product, but selection of a project is to be determined by the SMP criterion. Sector analysis is an analysis of the demand for products of individual sectors based on projected aggregate rate of income growth. After the project(s) in each sector has been selected, the input-output system can be used to determine the level of production in each sector as well as the amount of capital investment required. Aggregate analysis is chiefly concerned with the general rate of development through projections of such magnitudes as domestic savings ratio, possible foreign source of finance, population (labor force) growth rate, and the overall capital/output ratio.

By way of all these analyses, a trial overall program is formulated which, then, will have to be revised by adjusting accounting prices until SMP of capital is equal in all sectors and prices of commodities and factors are equal to their competitive equilibrium prices. In other words, the solution is at once consistent with projected demands and resource limitations and efficient in its use of resources. These, then, are the criteria for investment at the sector level and are the basic requirements for formulating development programs.

It is under this overall type of programming that we are going to show how investment is determined. The programming may be conducted by the use of highly formal mathematical method or by the use of pragmatic method. The present chapter will make use of the latter method as illustrated by Chenery in his empirical approach to programming.¹ But before dealing with the quantitative aspect, some discussion about the qualitative evaluation of sector growth may be in order.

2. Qualitative Evaluation and Sector Growth.

Since a very important step in programming is the

¹See H. B. Chenery, "Development Policies and Programmes," Economic Bulletin for Latin America, March, 1958, pp. 60-65. ~~It is to be admitted that the highly formal, mathematical approach is quite beyond the competence of the present writer.~~

determination of final demand, the problem arises as to how different sectors are to grow at different rates. In other words, on what basis are the projections of such demand made?

Final demand comes from three sources: consumption, investment, and export. They are to be satisfied by domestic production and imports, and because capacity to import is usually limited, import substitution is sought for with all means. Thus foreign trade is an integral part of sector-by-sector analyses. Now, how to project the final demand?

One answer is to project on the basis of income elasticities. But this kind of statistical projection is not all. Except for export demand which is mainly decided by conditions in foreign countries, the domestic final demand should also reflect the growth requirements of the economy. This implies some element of desired growth in the sense that mere statistical projections would not bring about development. Thus, we see the fixing of targets on the empirical scene¹ and the division of "steady growth" sectors and "development" sectors in theoretical discussions.² These two elements--statistical projection and desired growth targets--should both be taken

¹For example, so many more tons of coal and steel, so many more machine tools or tractors, so many kilowatts of additional power capacity, so many miles of road or railway, so many dollars worth of additional exports. These can be easily found in the economic development plans of underdeveloped countries.

²See B. Higgins, Economic Development, pp. 637-638.

into account in planning for sectoral growth. This is, of course, a very difficult job. Besides the technical intersectoral relationships, these two elements are sometimes conflicting with each other and the latter is subject to different interpretations due to different hypotheses or emphases. How to strike a balance out of them requires not only insight and determination, but also effective measures. We can be sure of one thing: any development program requires that the rate of growth of investment goods sectors should be faster than that of consumer goods sectors so as to achieve higher rate of capital accumulation and higher level of living (consumption) at some future date.

With different hypotheses on sectoral growth, the whole series of combination of projections by sectors will also be different. Our discussion in the foregoing chapter about the problem of where to invest (balanced or skewed) has its relevance here. As has been explained before, the growth of various sectors or industries should be decided in the light of the possible pattern or structure of the economy in the long run. This long-run pattern depends largely on the main economic facts peculiar to a country. They include: ratio of natural resources to population, degree of industrialization already achieved, size of the country, degree of openness to the outside world, importance and structure of exports, institutional framework in agriculture, etc. Based

on these factors, some qualitative generalizations about sectoral growth may be presented below:

a. For countries with high resource/population ratio and high export/national income ratio (with export exerting no great influence in the world market)--such as Central Africa, Central America, and the Middle East States--the export sector should lead in growth, and unbalanced expansion is therefore desirable.

b. For countries with high resource/population ratio, having achieved industrialization in some degree, and with export not very important--such as Brazil--agricultural sector should grow fast enough to supply both raw materials and manpower to industry. At the same time, new lines of export should be developed in order to meet import requirements arising from investment. Here, it seems that a balanced development is appropriate.

c. For countries with low resource/population ratio, low degree of industrialization, and low export/national income ratio and inelastic world demand for their exports--such as India, Pakistan--a big push along all fronts (agriculture, industry, new export lines, transportation, trade) may be deemed necessary.

d. For countries of small size with limited resources, growth has necessarily to be unbalanced with some sector(s) leading in the process, usually the export sector.

e. For all countries, the social overhead capital sector should grow along with whichever pattern the economy may develop into, as transportation and power are needed in almost every type of production. Empirically, investments in this sector fairly constantly come to about 20%-25% of total investment.¹

f. For countries open to the outside world, there is the need of increasing the rate of growth of export during the development process. This point will be discussed later.

Besides the above generalizations on pattern or structure, more may be said about sectoral growth and domestic production and imports:

a. Domestic production. Domestic production is intended to satisfy both export demand and domestic demand. The latter consists of demand for consumption goods, investment goods, and intermediate products. Conditions in underdeveloped countries are generally such that total domestic demand exceeds total domestic production so that imports are larger than the current capacity to import. In the short run, the gap may be met with capital imports; but, eventually, foreign borrowings have to be serviced and repaid with exports.

¹See J. Tinbergen, The Design of Development, p. 31. Also pp. 90-91.

Domestic production may be grouped under two headings, export sector(s) and home-market sectors. The growth of export sector(s) is influenced more by foreign than by domestic factors. Here, the quantity demanded is determined by the income level, income elasticities, and possible substitutes in foreign countries. Home-market sectors may be divided into: agriculture, manufactured consumer goods and intermediate products, services, and capital goods.

The growth of agriculture is relatively more difficult. Aside from land scarcity, it involves substantial structural change in institutional framework (ownership and tenure), in techniques and methods, and in land improvement (irrigation, forestation, rehabilitation). The manufacturing sector is easier to grow as it involves less drastic structural change (e.g., from handicraft to machine operation, from small to large scale). The growth of capital goods sector, consisting mainly of metals, machines, and equipment, depends on such factors as technical know-how, natural resources (especially iron ore), large market, and large capital investment. Some of these factors are lacking in some countries. This is considered the sector that should grow at a faster rate and one in which there is a large gap between demand and domestic production.

b. Imports. In the process of development, imports are bound to increase and increase considerably for two reasons.

First, development calls for larger investment, and larger investment requires larger amount of capital goods, raw materials, and fuels which mostly have to be imported. A higher rate of investment means a higher rate of imports. Secondly, as national income increases with investment, demand for imported consumption goods will also increase. These two forces make the rate of growth of imports larger than that of real GNP, and far larger than that of exports. In Latin America, for example, total gross product of the area as a whole rose by 35% during the period 1950-1957, while gross domestic investment rose by 56% and merchandise imports rose by 55%. This compares with the much less growth of merchandise exports of 23%. With few exceptions, countries whose imports have risen substantially during the post-war period have had relatively high rate of growth.¹

With shortage of foreign exchange in almost all underdeveloped countries, this necessarily calls for import substitution. But this is a difficult and complicated problem.

c. Import substitution or export expansion? There are two aspects of the problem which have to be considered. One is the choice between import substitution and export expansion, whichever is more advantageous. This will depend on

¹See U.S. Senate, Committee on Foreign Relations, Problems of Latin American Economic Development, Study No. 6, pp. 79-81. Also R. F. Mikesell, Financing of Economic Development in Latin America, Pan American Union, Washington, D.C., 1958, pp. 63-68.

whether the marginal revenue or (SMP) from an additional unit of investment in export industry is larger or smaller than that in import substituting industry.¹ Another aspect of the problem is what product is to be substituted, if import substitution is advantageous. Again, the SMP criterion can be applied, although it is often complicated by the existence of multiple exchange rates and import controls.

In practice, however, the range for import substitution is very limited.² For small countries with a small resource base or countries in their initial stage of development, import substitution is often impossible. This is because certain technical conditions (minimum scale, specific factors, etc.) have to be satisfied before the substitution can take place. Even consumer goods substitution is difficult because new products are constantly emerging in advanced countries, so that there seems to be no end of substitution.

On balance, it is export expansion that is vital to the maintenance of a higher rate of investment and growth. Among other things, efforts toward enlarged exports should include:³ (1) Diversification of exports to overcome demand

¹See C. P. Kindleberger, Economic Development, McGraw-Hill, New York, 1958, pp. 240-241, also p. 255.

²Mikesell, op. cit. p. 60.

³Ibid., pp. 163-166. Also Mikesell, Intra-Regional Trade and Economic Development, International Development Advisory Board, Washington, D.C., December, 1958.

inelasticities and to meet the requirements of shifting world demand. New lines of export, such as new primary products, processed primary products, semi-manufactures, or even manufactures, should be developed. (2) Establishment of regional free trade area to liberalize trade and enlarge export market.

3. Quantitative Determination in Sector Projection and Program Formulation: SMP and Accounting Prices.

Based chiefly upon the studies made by the Economic Commission for Latin America,¹ the steps of development programming may be outlined as follows:

a. Project the growth in national income, the supply of resources, and the balance of payments. Given the overall capital/output ratio and the amount of domestic savings and foreign assistance over the given period, the rate of income growth over the same period can be determined. This rate should exceed the rate of population growth, and the extent of excess will depend on the extent of people's willingness to accept austerity. A 2% per annum growth in per capita income may be considered as an appropriate rate, although some opined that it is advisable for a national economy to save less in the beginning and more in the later years. The capital/output ratio may be estimated on the basis of

¹United Nations, ECLA, Analyses and Projections I, II, and III.

of past experience. The supply of resources means the available supply of scarce factors such as labor, capital, foreign exchange, and specific resources.

b. Estimate final demand and demand for intermediate products. As explained before, the estimate of final demand should be based not only on statistical projections of past trends and elasticities of demand at home and abroad, but also on the long-term growth requirements of the economy. The demand for intermediate products (current inputs) is determined by input-product coefficients. This will be discussed below.

c. Select investment project(s) in each sector after the choice between imports and domestic production has been made.¹ This involves choosing different investment possibilities (or production techniques) in each sector, each differing in factor inputs (capital, labor, land, foreign exchange, etc.) and current inputs (outputs from other sectors, or inter-sectoral transactions). Sometimes the margin of choice of technology may be very narrow, indicating relatively rigid coefficients of production.

After these steps, the components of an input-output table showing demand structure, production possibilities,

¹This seems to mean a choice of either imports or domestic production. Actually, some commodities would be both domestically produced and imported. The proportion of imports to domestic production would then have to be fixed.

Table 4.1. A Hypothetical Input-Output Table

	<u>Inputs and Outputs</u>	<u>Industry 1</u>			<u>Industry 2</u>			<u>Final Demand</u>			<u>Imports</u>	<u>Total</u>
		<u>Commodity 1</u>			<u>Commodity 2</u>			<u>Investment</u>	<u>Consumption</u>	<u>Export</u>		
		(Production possibilities:)			<u>Ind. 1</u>	<u>Ind. 2</u>						
		<u>1_a</u>	<u>1_b</u>	<u>1_c</u>	<u>2_a</u>	<u>2_b</u>	<u>2_c</u>					
Current Inputs:	Commodity 1 (Industry 1)	60		40			7	6	167	30	-10	300
	Commodity 2 (Industry 2)		30		80		28	18	74	30	-50	210
Factor Inputs:	Labor)											
	Land)											
	Capital)	210		80								290
	<u>Total</u>	300		200			35	24	241	60	-60	800

Note: In the above table, the production possibilities 1_b and 2_b are selected and income payments to factors are expressed in lump sums instead of breakdowns.

Source: See United Nations, ECAFE, Programming Techniques for Economic Development, With Special Reference to Asia and the Far East, Report of the First Group of Experts on Programming Techniques, January, 1960, Chapter V, Doc. No. E/CN.11/L.77 (mimeographed).

and inter-sectoral transactions can be determined. They would look something like this:

The selection of investment projects is to be determined by the value of social marginal productivity (SMP) of capital. The contribution of each investment possibility to national income is calculated by valuing inputs and outputs at social or accounting prices, not at market prices. The net value added by capital or the return to capital is obtained by deducting from the value of output the costs of all inputs except capital. This is called the "social profit." Social profit per unit of capital invested is called social marginal productivity (SMP) of capital, which will be the accounting price for capital, or the opportunity cost of capital. The project with the highest SMP value will be selected.

The accounting prices are applicable to the economy as a whole, not to the project alone. They cannot be set in advance, but have to be determined by trial and error until the conditions of general equilibrium of the system are satisfied.

(For more discussion of SMP and other criteria for selecting investment projects, see the appendix to this Chapter.)

d. Formulate a trial program composed of levels of domestic production and imports.¹ Once the projects have

¹The demand stated in b and domestic production and imports stated here are all in the additional sense, i.e., the existing installed capacity is already fully employed.

been selected, the input-product coefficients of such projects can then be used in an input-output system to determine the amount of production in each sector. Finally, for each commodity, the domestic production plus imports (if any) will just satisfy the requirements of final demand and current input, and a trial program is thus formulated.

3. Determine the total uses of scarce factors. Having determined the domestic production and imports, capital and other scarce factors required in production can also be determined. These requirements should then be compared to the available supplies of each.

f. Revise or improve the trial program by way of successive approximation until an optimal program is reached. This step consists of two parts. One is to revise the overall growth rate as well as the projected demand when factor requirements far exceed their supplies under every possible method of production. Another is to improve the allocation of resources without revising the overall growth rate and the projected demand by repeatedly adjusting prices and by applying the SMP criterion until finally the accounting (or equilibrium) prices are established and the highest SMP in one sector is equal to the highest SMP in another. In other words, an optimal program is reached only after the following general equilibrium test is satisfied:

- (1) Demand must equal supply for both commodities and factors of production;
- (2) Capital must be allocated to the most productive of alternative uses so that the selected project in each sector has the highest SMP and the highest SMP in one sector is equal to that in others;
- (3) Commodity prices must equal the cost of all the inputs used to produce them (profits in excess of the marginal productivity of capital must be zero); factor prices must equal their opportunity costs.

4. A Numerical Illustration.

In accordance with the above steps, Chenery has shown with a simplified numerical example how investment projects are selected, how levels of production and investment are determined, and how the program results in efficiency and consistency. The example is presented below:¹

a. Assumptions:

Two sectors, each producing one commodity;
Two factors of production: capital and labor;
No imports and exports.

b. The Data:

Final demand for commodity 1 is estimated at 100 units;
Final demand for commodity 2 is estimated at 50 units;
Labor supply is 2,000 units;
Capital amount is not fixed, but its use is to be minimized;
Each commodity has three possible production techniques (or projects) which are expressed in terms of input coefficients per unit of output; each technique operates at constant cost;
Inputs are indicated by minus signs and outputs by plus signs.

¹Chenery, op. cit., pp. 62-65.

The above data is shown in the following table:

Table 4.2. Choice of Technology

Inputs and Outputs	Production Activities						Restrictions	Market Prices
	Industry 1			Industry 2				
	A ₁	A ₂	A ₃	A ₄	A ₅	A ₆		
Commodity 1	1	1	1	-0.2	-0.5	-0.8	100	1.00
Commodity 2	0	-0.25	-0.5	1	1	1	50	1.00
Labor	-12.5	-7.5	-6	-15	-5	-4	2000	0.08
Capital	1.1	1.25	0.3	1	2.5	0.6	Minimum	

c. Select investment projects and formulate a trial program.

Using the above data and the market prices as a first approximation, we have:

$$\text{SMP of } A_1 = \frac{1 - 0 - (12.5) \times (0.08)}{1.1} = \frac{1 - 1}{1.1} = 0$$

In a like manner,

$$\text{SMP of } A_2 = 0.12; \quad A_3 = 0.07;$$

$$A_4 = -0.4; \quad A_5 = 0.04; \quad A_6 = -0.2$$

It is evident that project A₂ and project A₅ will be chosen, as they have the highest SMP value in each industry. Fitting these selected projects into the input-output system, the amount of production in each industry (sector) can be determined:

$$\begin{aligned} 1 X_2 + 0.5 X_5 &= 100 \\ -0.25 X_2 + 1 X_5 &= 50 \end{aligned}$$

X_j is the output of activity j.

Solving,

$$\begin{aligned} X_2 &= 143 \text{Output of commodity 1;} \\ X_5 &= 86 \text{Output of commodity 2.} \end{aligned}$$

The total amount of labor and capital required will be:

$$\begin{aligned} L &= 7.5 X_2 + 5 X_5 = 7.5 \times 143 + 5 \times 86 = 1,500; \\ K &= 1.25 X_2 + 2.5 X_5 = 1.25 \times 143 + 2.5 \times 86 = 393. \end{aligned}$$

d. Improve the trial program. The above trial program is evidently not optimal, because labor required is 1,500 units while its supply is 2,000 units. This indicates that the market price for labor (0.08) overstates its opportunity cost and that a lower price should be used instead.

By repeatedly adjusting the prices of both labor and output, and by applying the marginal productivity criterion, the following trial programs can be worked out and finally program g will be the optimum program that satisfies all the three conditions for general equilibrium!

Table 4.3. Selection of Projects by Varying Accounting Prices

Trial	Accounting Prices			SMP of Capital					
	P ₁	P ₂	P _L	Industry 1			Industry 2		
				1	2	3	4	5	6
a	1.0	1.0	0.08	0	0.12*	0.07	-0.40	0.04*	-0.20
b	1.0	1.0	0.0	0.30	0.60	1.67*	0.80*	0.20	0.33
c	1.0	1.0	0.05	0.34	0.30	0.67*	0.05	0.10	0
d	1.0	1.0	0.046	0.39	0.32	0.75*	0.11*	0.11*	0.02
e	0.82	1.0	0.046	0.22*	0.18	0.14	0.15	0.14	0.27*
f	0.82	1.0	0.035	0.35	0.25	0.37*	0.31	0.16	0.38*
g	0.82	1.0	0.038	0.32*	0.25	0.32*	0.27	0.16	0.32*

Notes: P₁.....Price for commodity 1 * Means most profitable project
P₂.....Price for commodity 2
P_L.....Price for labor

Table 4.4 Determination of Production Levels and Factor Use

Trial	Production Levels						Capital K	Labor L	Excess demand (L-2000)	P _L
	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆				
a		143			86	393	1500	+500	-0.08	
b			122	111		148	2400	+400	+0.05	
c			167		133	383	1667	+333	+0.04	
d			146	51	73	276	2000	0	0	
e	140					80	164	-80	-0.011	
f			233			167	170	+67	+0.003	
g	80		100			100	178	0	0	

The improvement consists of two stages. First is improvement on the price of labor. Trial a, b, c result in excess supply of or excess demand for labor, until trial d where exactly 2000 units of labor are employed, three production activities (X₃, X₄, and X₅) are selected, and 276 units of capital are invested.

Stage 2 is improvement on commodity prices and is a repetition of stage 1. Trial d, although equilibrating the demand and supply of labor, leaves the marginal productivity of capital unequal in industry 1 and industry 2 (0.75 vs. 0.11). This indicates that the price of commodity 1 overstates its value relatively to commodity 2, because equilibrium price requires equal return to capital in each use. By equating commodity price with the cost of inputs, we have the following simultaneous equations corresponding to

production possibilities A_3 , A_4 , and A_5 under trial d:

$$\begin{aligned} A_3 : \quad 1P_1 &= 0.5P_2 + 6.0P_L + 0.3P_K \\ A_4 : \quad 1P_2 &= 0.2P_1 + 15.0P_L + 1.0P_K \\ A_5 : \quad 1P_2 &= 0.5P_1 + 5.0P_L + 2.5P_K \end{aligned} \quad \begin{array}{l} P_K \text{ is the} \\ \text{price for} \\ \text{capital} \end{array}$$

Rearranging and taking the price of commodity 2 as given (i.e., $P_2=1$), the above equations become:

$$\begin{aligned} A_3 : \quad 1P_1 - 0.5 &- 6.0P_L - 0.3P_K = 0 \\ A_4 : \quad -0.2P_1 + 1.0 &- 15P_L - 1.0P_K = 0 \\ A_5 : \quad -0.5P_1 + 1.0 &- 5P_L - 2.5P_K = 0 \end{aligned}$$

Solving, $P_1 = 0.62$
 $P_L = 0.046$
 $P_K = 0.146$

However, with the new price for commodity 1, the relative profitability of various projects is different. This can be seen from trial e where activities A_1 and A_6 have the highest SMP. There is also excess supply of labor. Again, by revising the price of labor, we finally arrive at a solution under trial g where SMP is equal among the chosen activities of A_1 - A_5 - A_6 , the demand and supply of labor is 2,000 units, the amount of production in each sector is 180 and 100 units respectively, the capital required is 178, the price of capital is 0.32, and all the three conditions of general equilibrium are satisfied.

5. A More Simple Approach.

The simultaneous determination of all relationships in a model like the one above will entail a tremendous task when the number of sectors is large. For under-developed countries a simpler method may be more useful. The following will give a brief description of how sector growth and project selection is determined when inter-sectoral transactions are neglected:¹

a. A two-sector growth model. Suppose the economy consists of consumption goods sector and investment goods sector only. The investment goods sector is to provide goods for both consumption sector and for investment sector, itself, so that the productive capacity of both sectors could increase over time. Given the desired rate of growth, the consumption-income ratio, and the capital-output ratio of each sector, the growth of both sectors can be determined and the sum of their net outputs should equal national income. If income grows at a constant rate each period and consumption-income ratio remains constant, then the two sectors grow at the same rate as income grows. This may be shown in the following numerical example:

¹See United Nations, ECAPF, op. cit., Chapters III and IV. Illustrative figures used here are all borrowed from it.

Table 4.5. A Two-Sector Growth Model

From	To	Consumption	Investment	Total
		In consumption	In investment	Product
		goods sector	goods sector	
<u>First Period</u>				
Consumption		800		800
goods sector		$0.8 \times 1,000$		
Investment			200	200
goods sector		3.5×40	6×10	
Income		800	200	1,000
payment				
<u>Second Period</u>				
Consumption		840		840
goods sector		$0.8 \times 1,050$		
Investment			210	210
goods sector		3.5×42	6×10.5	
Income		840	210	1,050
payment				

- Note: 1. Income at first period is 1,000; grows at 5% per period according to plan;
2. Consumption-income ratio is kept constant at 0.8 (80/100); or the relative ratio of consumption/investment is kept at 4:1;
3. Capital/output ratio for consumption sector is 3.5, for investment sector is 6.

In the above example, if the 200 investment goods are all used to increase the productive capacity of the consumption sector in period 1 and will remain to be so in subsequent periods, then, in period 2 investment sector's capacity will remain 200, while consumption sector will become 857

and income will increase by 5.7%. But from period 2 on, consumption grows only by a constant amount of 57 and income growth will gradually decrease.

If, on the other hand, it is planned that consumption is to be raised to a high level at a certain future period rather than at present, then the consumption-income ratio during early periods must be reduced and more investment goods must be reserved for the investment sector in order to build up its capacity for the production of more consumption goods in the future.

b. Selection of project. Assuming that the general aims of government development policy are already known and have been expressed in terms of targets over the planning period, then the selection of project can be briefly stated as follows:

First, ascertain the impact of a project. Besides the non-measurable impact which is a matter of subjective judgment, the measurable impact of a project has its many aspects: impact on national income, on national savings, on employment, on public health, etc. Each aspect of the impact, in turn, has its primary and secondary effects. In practice, it is impossible to measure all of them. Only important aspects and effects can be considered and roughly estimated.

For purpose of illustration, we may assume that only the following aspects of project impact are considered and their targets set by the planning authority:

- A: Increase in national income--overall target: \$1,000 million;
 B: Increase in employment--overall target: 1 million persons;
 C: Increase in savings--overall target: \$400 million.

Furthermore, the impact of Project 1 and Project 2 in terms of the above targets are estimated as follows:

<u>Project 1</u>	<u>Project 2</u>
a ₁ = \$1 million	a ₂ = \$0.8 million
b ₁ = 500 persons	b ₂ = 1,000 persons
c ₁ = \$0.5 million	c ₂ = \$0.1 million

The amount of capital required

k₁ = \$2 million k₂ = \$1.2 million

Secondly, determine project priorities. Assume again our purpose is to economize the use of the scarce factor capital. The simplest test is the contribution to income per unit of capital (the output/capital ratio) according to which Project 2 is to be selected because $\frac{a_2}{k_2} (= \frac{0.8}{1.2}) > \frac{a_1}{k_1} (= \frac{1}{2})$. But here the contribution has three aspects: income, employment, and savings. The criteria must therefore be based on an evaluation of the relative weight of each of these aspects. This is a combined test which may be illustrated as follows:

Assuming the relative equivalent of increases in various aspects to be: \$1 million increase in income = 500 persons increase in employment = \$0.2 million increase in savings, then,

Valuation of Project 1: $V_1 = \frac{\$1 \text{ million} + 500 \text{ persons} + \$1 \text{ million}}{\$1 \text{ million} \quad 500 \text{ persons}}$

$$\frac{\$0.5 \text{ million}}{\$0.2 \text{ million}} = 1 + 1 + 2.5 = 4.5$$

Valuation of Project 2: $V_2 = \frac{\$0.8 \text{ million}}{\$1 \text{ million}} + \frac{1000 \text{ persons}}{500 \text{ persons}}$

$$\frac{\$0.1 \text{ million}}{\$0.2 \text{ million}} = 0.5 + 2 + 0.5 = 3.3$$

Since $\frac{V_1}{K_1} (= \frac{4.5}{2}) < \frac{V_2}{K_2} (= \frac{3.3}{1.2})$, therefore Project 2 is

selected. The selection of projects will then be made according to the order of this ratio, from the highest to next highest until all capital available for investment is fully utilized.

Projects thus selected may not give rise to the same increases in income, employment, and savings as originally planned. The cause for this may be that the relative equivalents are not appropriate so that some of the increases--for example, employment--falls short of the target. It is then necessary to revise the valuation of employment upward so that projects with relatively larger contribution to employment will have a larger valuation ratio.

Or it may be that the plan itself has to be revised downward or upward, depending upon whether the targets are impossible to attain or are all surpassed. This means the plan may have been based on unrealistic coefficients.

Or it may be that the estimation of the impact of projects--i.e., a_1, b_1, c_1 , etc.--has been erroneous, in which case the plan itself is not to be revised.

When other scarce factors than capital (foreign exchange, skilled labor, etc.) are also used, then the denominator of

the valuation ratio should not be capital alone, and the valuation of relative equivalents must also be introduced for factors of production. Here, too, the selected projects may require more (or less) of the scarce factors than their supply, and the above-mentioned procedure of trials and revisions must be repeated.

Appendix to Chapter IV

INVESTMENT CRITERIA FOR DEVELOPMENT PROJECTS

1. Types of Criteria.

Since any pattern of future production must ultimately materialize as a set of individual projects, the importance of investment projects in the overall development program is self-evident. A variety of methods or criteria has been suggested for selecting development projects, because the market-price mechanism does not provide a reliable guide. But they in turn have defects, too. They are either too complicated or over-simplified, and the major problem common to them all is the great difficulty in actual measurement or estimation.

Here, without going into details, we will give only a brief description of some of the important criteria developed in recent years.¹ These may be roughly grouped as follows:

a. Criteria based on the productivity of a single factor, usually capital:

Private viewpoint:

- (1) Profit per unit of capital (profitability);
- (2) Gross production value per unit of capital (capital turnover).

¹For a comprehensive discussion, see United Nations, ECLA, Manual on Economic Development Projects, New York, 1958, especially pp. 216-242.

Social viewpoint:

- (1) Social marginal productivity of capital (SMP);
- (2) Net value added per unit of capital (product/capital ratio);
- (3) Employment per unit of capital (the employment coefficient);
- (4) Net value added per unit of labor (product/labor ratio, or labor productivity);
- (5) Foreign exchange earned or saved per unit of foreign exchange spent in investment alone or in investment and operation.

b. Criteria based on the productivity of the input

complex:

- (1) The benefits-costs ratio;
- (2) Direct and indirect value added per unit of total input.

c. Combined criteria:

- (1) Stanford Research Institute's criteria for industrial projects;
- (2) K. A. Bohr's manufacturing industries investment criteria.

2. Criteria Based on the Productivity of a Single Factor:

Private Viewpoint.

a. Profit per unit of capital: Profitability. The basic purpose of a private entrepreneur is to secure maximum profit per unit of capital employed in the project. The difficulty here is how to define capital and profit. Capital may mean fixed or circulating capital, or equity or borrowed capital. The calculation of profit also depends on how depreciation and interest are considered. In calculating the profit ratio, it is therefore necessary to specify how and on what bases the estimates of both capital and profits are derived.

The profit ratio may be described as the ratio of net income (difference between total annual earnings and annual production costs, including the costs of operation, maintenance, taxes, insurance, etc.) to the amount of capital invested. However, this net income has to be compared with the annual capital cost (including depreciation and interest in the case of equity capital, or amortization payment and interest in the case of borrowed capital) in order to determine "net profit." To facilitate comparison and to calculate profitability for the whole of the project's useful life, the method of uniform annual equivalent standard cost may be used to convert a given initial capital investment into a series of equal annual values by using the "capital recovery factor" (c.r.f.). Thus, the c.r.f. for 10 years useful life at 6% interest is 0.13587 according to financial tables. If the initial investment is \$10,000, then the equivalent annual cost or value of the investment = $10,000 \times 0.13587 = 1,359$. If net income is equal to 1,359, then there is no net or excess profit. This means that, besides depreciation, the rate of return to investment is just equal to the market rate of interest.

b. Gross production value per unit of capital: Rate of capital turnover. The capital turnover rate (its reciprocal is called capital intensity) indicates the production

value that can be attained by a given amount of investment. But, as pointed out by Prof. Kahn, this represents only the contribution of capital to the private investor, not to the national product.¹ The latter is the social marginal productivity thesis.

3. Criteria Based on the Productivity of a Single Factor: Social Viewpoint.

a. Social marginal productivity of capital (SMP). The social marginal productivity thesis represents an attempt to restore the profitability criterion by correcting market prices. In measuring the productivity of capital in terms of its contribution to national income, the value of production as well as costs are calculated at social prices, not market prices. The calculation² involves three important corrections of the market price:

First, the value of production (or output) is priced socially. Tariffs, taxes, and subsidies are deducted from the market price of the output, while external economies originated from the production are added to the market price.

Second, domestic factors used in the production, especially labor, are priced at their opportunity costs.

¹A. E. Kahn, "Investment Criteria in Development Programs," The Quarterly Journal of Economics, February, 1951, p. 38.

²See H. B. Chenery, "The Application of Investment Criteria," The Quarterly Journal of Economics, February, 1953, pp. 76-96.

Third, foreign exchange income and costs are calculated at the equilibrium exchange rate. Whenever there is under- or over-valuation of the exchange rate, the total net effect of the project on balance of payments position should be multiplied by a corrective factor r ($= \frac{\text{Equil. exch. rate} - \text{Official exch. rate}}{\text{Official exch. rate}}$) with the product thereof added to or deducted from the production value of the profit.

After the above corrections, we have (1) social value of production, (2) social cost of production, and (3) balance of payments premium. The SMP can be expressed in the following formula:

$$\text{SMP} = \frac{V}{K} - \frac{C}{K} + \frac{r \cdot X \cdot B}{K}$$

Where

V (social value of production or social values added) $= X + E - M_1$

X = Increased market value of production from the project, excluding tariffs, taxes, and subsidies;

E = Value added to production due to external economies;

M_1 = Imported input factors;

C (social cost of production) $= L + M_d + O$

L = Labor cost;

M_d = Cost of domestic materials;

O = Overhead costs, including administration and replacement;

B (total net effect on balance of payments) $= aB_1 + B_2$

a = Combined amortization and interest rate on foreign loans, i.e., capital recovery factor (c.r.f.);

- B_1 = Effects of installation of the project on balance of payments, always negative; direct effect (purchase of machinery and equipment abroad) and indirect effect (multiplier effect of the investment on income and imports);
- B_2 = Effects of the operation of the project on balance of payments, either negative or positive; also direct and indirect effects.

The above formula may be rewritten as:

$$SMP = \frac{V}{K} \times \frac{V - C}{V} + \frac{r \times B}{K} .$$

This means that a low value of $\frac{V}{K}$ (capital productivity) can be offset by a high value of $\frac{V - C}{V}$ (Profits / Value added) if $\frac{r \times B}{K}$ remains unchanged.

Or it may be rewritten as:

$$SMP = \frac{X - (M_1 + L + M_d + O)}{K} + \frac{E}{K} + \frac{r \times B}{K} .$$

This means that SMP is obtained by calculating first profits in their conventional sense (i.e., production value minus production costs, all at social prices), then adding the corrective effects of external economies and exchange rates.

It is to be pointed out that there is no material difference between the SMP formula here and the calculation of SMP in Chapter IV, except that in Chapter IV, SMP is calculated in terms of inputs and outputs of the project valued at accounting prices.

b. Net value added per unit of capital: The product-capital ratio. This differs from the capital turnover rate

in that the net value added is obtained by deducting from the annual gross production value the purchases from other enterprises, the depreciation, and the indirect taxes and subsidies. The reciprocal of this ratio is the generally known "capital coefficient."

The most difficult problem with the value added approach is the measurement of indirect value added. For, if capital productivity is measured only in terms of direct value added, it has no special advantage as a criterion for those social overhead projects (power, transportation) which have low direct value added but very high indirect benefits.

The indirect effects are of two kinds: forward and backward, which bear the same meaning as "forward linkage effect" and "backward linkage effect" in Chapter III. The important point here is that the backward or forward values added by those industries affected by the project will be attributable to the project only insofar as such values added are brought about without new investment in such industries (i.e., they have idle capacity so that when the backward or forward effect comes, they can expand production and add additional income without making new investment).

c. Employment per unit of capital: The employment coefficient. In over-populated countries where general unemployment or underemployment is prevalent, projects giving larger employment per unit of capital invested will have

higher priority. This is especially true in ECAFE countries where labor-absorbing activities (cottage industry, construction works) are emphasized along with capital-intensive activities. This, of course, involves the issue of technological progress, long-run effects on productivity of labor, and effects on rates of saving and capital accumulation, which have been discussed in Chapter III.

In calculating employment coefficient (its reciprocal is called "capital density"), it is important to include not only direct employment, but also indirect employment which may be very important although difficult to measure. The following table from Leontief's studies may serve to indicate the significance of indirect employment:

Table A.1. Total and Direct Employment Coefficients for Various Branches of Production: United States Experience, 1939

(Unit: 1,000 persons employed per \$1 million of final demand)

Industry	Employment coefficient	
	Total	Direct
Agriculture and foodstuffs	1.1393	0.7239
Minerals	0.5859	0.1595
Metals	0.5057	0.2461
Fuel and power	0.5176	0.1775
Textiles and leather	0.7701	0.3563
Railway transport	0.4886	0.2429
Foreign trade (imports)	0.7657	--
Industries, unclassified	0.6120	0.2029
Government (taxes)	0.4076	0.0739
All other industries	0.5394	0.4125

Source: W. W. Leontief, "Output, Employment, Consumption, and Investment," The Quarterly Journal of Economics, February, 1944, p. 312.

d. Net value added per unit of labor: Labor productivity. The labor force may be expressed either in physical terms (man/years, man/hours) or in monetary units of labor cost. Accordingly, coefficients for measuring labor productivity are expressed either as (1) Net value added of annual production per man/year, or as (2) Net value added to production per unit of value added by labor (i.e., the cost of labor). The reciprocal of labor productivity is called "labor intensity."

Higher productivity of labor usually implies larger capital employed per unit of labor. It also implies higher quality of labor, or well trained, skilled labor which is a scarce factor in under-developed countries. The latter implication is not in conflict with the employment criterion which is generally meant for unskilled labor.

e. Foreign exchange earned or saved per unit of foreign exchange component of the investment or per unit of foreign exchange input. The foreign exchange effects of a project are very complex, as is indicated in Chenery's equations.¹ They may be divided into (1) direct effects (positive and negative effects directly connected with the project) and (2) indirect effects (the project's backward and forward effects involving foreign exchange transactions, positive

¹ That is, equations for the calculation of B_1 and B_2 (which is subdivided into B_2^1 and B_2^2). See Chenery, op. cit., p. 89.

and negative)

The evaluation coefficient may be expressed as the foreign exchange product-to-capital ratio which is obtained by dividing net annual foreign exchange effect (positive and negative effects together) by foreign exchange component of the investment. It indicates the productivity of the foreign exchange invested. When the direct recovery of capital in foreign exchange is fairly rapid (say, 3-6 years), this ratio will be useful.

Or it may be expressed as the foreign exchange product-to-input ratio by dividing total annual foreign exchange earnings or savings (i.e., positive effects only) by foreign exchange inputs required both for investment and for operation of the project. As this calculation takes into account the whole of the project's useful life, the present worth (or the equivalent annual cost) method may be used. The numerator would then be the present worth of total annual positive effects and the denominator would be the present worth of annual negative effects plus the initial investment.

The following example illustrates how these are calculated:

Basic data:

Dollar component of investment.....	\$4 million
Annual direct gross savings in foreign exchange	\$1 million
Direct annual input of foreign exchange for operation	\$0.2 million

Equivalent annual cost of capital in dollars (depreciation plus interest at 8%, 20 years period)..... \$0.407 million (c.r.f. = 0.10185)

Then the Net effect ratio would be $1 - \frac{0.2 + 0.407}{4} =$

0.1. The product-to-input ratio would be as follows:

	Interest rates (Value in \$ million)				
	20%	15%	8%	4%	0
1. Present worth of annual gross income (\$1 million, for 20 years)	4.87	8.51	11.47	13.59	20.0
2. Present worth of annual input factors	4.97	5.70	6.29	6.72	8.0
a. \$0.2 million for operation, for 20 years	0.97	1.70	2.29	2.72	4.0
b. Initial investment	4.00	4.00	4.00	4.00	4.0
3. Foreign exch. product-to-input ratio:	0.98	1.49	1.82	2.02	2.5

Source: See United Nations, ECLA, Manual on Economic Development Projects, p. 231.

4. Criteria Based on the Productivity of the Input Complex.

a. The benefits-costs ratio. The criterion here is maximum production with minimum total costs (costs of the whole input complex: annual production costs plus equivalent annual cost of capital). Conceptually, the social criterion of benefits-costs has the same meaning as the private criterion of profitability of capital, because when profits are maximized, this ratio will also be maximized:

$$\text{Benefits-costs ratio} = \frac{\text{Benefits}}{\text{Costs}} = \frac{\text{Costs} + \text{Profits}}{\text{Costs}} = 1 + \frac{\text{Profits}}{\text{Costs}}$$

It is much easier to calculate this ratio in terms of direct benefits and costs only, but it is necessary that indirect benefits and costs should also be included in order to reflect the true social advantage. In addition, opportunity costs sometimes may have to be used instead of market prices (e.g., labor cost during general unemployment.)

This combined direct and indirect effects criterion has been especially recommended by a sub-committee of the U.S. Federal Inter-Agency River Basin Committee. The evaluation methods as recommended are as follows:¹

(1) Definitions:

Primary benefits of the project--The value of immediate products (or services) of a project. In the case of an irrigation project, they may be the value of wheat produced by the farmer using the irrigation water.

Secondary benefits of the project--The values added over and above the value of the immediate products (or services) as a result of activities stemming from or induced by the project. They would not have occurred if the project had not been undertaken. In other words, the industries affected by the project must have had idle capacity or have

¹See U.S. Federal Inter-Agency River Basin Committee, Proposed Practices for Economic Analysis of River Basin Projects, Washington, D.C., 1950. Also United Nations, Formulation and Economic Appraisal of Development Projects, Vol. I, Part II, 1951, pp. 118-127.

utilized the external economies created by the project. In the wheat case, the difference between value of bread and value of wheat represents the secondary benefits.

Primary costs of the project--These include direct and associated costs. Direct costs are the value of goods and services used for establishing, maintaining, and operating the project throughout its useful life (100 years as limit). These include: initial investment in land; labor and materials; cost for replacement, maintenance, and operation; cost of investigations and engineering inspection; and administration and overhead in general. In the case of irrigation project, they are the costs for placing the water at the disposal of the farmer. Associated costs are the value of goods and services needed over and above those needed by the project itself in order to make the immediate products (or services) of the project available for use or sale. These are non-project costs. In the wheat case, they are the costs of growing wheat.

Secondary costs of the project--These are costs of the activities stemming from or induced by the project over and above the direct and associated costs. They are also non-project costs. In the wheat case, they are the costs of transport and milling the wheat and baking and distributing the bread.

From the above, the benefits-costs ratio can be obtained:

Project benefits (or net benefits attributable to the project) = (Primary benefits - associated costs) + (secondary benefits - secondary costs);

Project costs = Direct costs of the project;

Benefits-costs ratio = $\frac{\text{Project benefits}}{\text{Project costs}}$.

(2) Measurement:

Ideally, all primary and secondary benefits and costs are included and prices reflect true social interest. But, in practice, and in normal cases, only primary effects are included and only market prices are applied. The market prices are those reasonably expected to prevail at the time when the benefits and costs are expected to occur. Besides, to make the values attached to benefits and costs at their time of accrual comparable, the formula of equivalence has to be used so that they can be converted into present worth or equivalent annual values. The following example, considering only primary effects, shows how the ratio is calculated:

Table A.2. Calculation of Benefits-Costs Ratio:
An Illustration

		(dollars)
1. Calculation of Total Annual Direct Cost		
(a)	Operation and maintenance	10,000
(b)	Equivalent annual cost of capital (initial investment \$1 million, last 75 years, interest rate at 3%, c.p.f. is 0.03367)	<u>33,700</u>
	Total annual cost	43,700
2. Calculation of Annual Benefit		
(a)	Increase in net annual farm income in years 11-75 (gross benefits to farmer \$100,000 - operating expenses \$30,000)	70,000
(b)	Present worth at beginning of 11th year (70,000 x 28.463)	1,922,000
(c)	Present worth of net benefits at end of construction (1,922,000 x 0.7441)	1,482,000
(d)	Annual equivalent value of (c) in 75 years (1,482,000 x 0.03367)	49,900
3. Benefits-costs ratio = $\frac{\text{Benefits}}{\text{Costs}} = \frac{49,900}{43,700} = 1.14$		

Source: See United Nations, ECLA, Manual on Economic Development Projects, p. 236.

b. Direct and indirect value added per unit of total input. This coefficient measures the productivity of the input complex and is used by Jorge Ahumada as a criterion for determining investment priorities.¹ "Productivity" is expressed as the net direct and indirect value added of the project, including profits. The input complex include not

¹See Jorge Ahumada, Investment Priorities, document submitted to the round-table conference of the International Economic Association, Rio de Janeiro, 19-23, August, 1967.

only the resources needed for investment, but also those needed for operation of the project in order to obtain such added values. Profits are again included as payment for entrepreneur's services.

Besides considering both direct and indirect effects, social pricing is also introduced. The net value added (the numerator of the formula) is calculated at market prices, but eliminating subsidies, taxes, and tariffs. The resources used for investment and operation (the denominator) are priced socially by eliminating subsidies, taxes, and tariffs (in case of inputs) and by pricing at opportunity costs (in case of factor inputs).

The formula, proposed by Ahumada, is as follows:

$$\frac{VA}{i} = \frac{VAP - VAP' - VAP''}{(CP + CP') \times r}$$

Where

VA = total value added
 VAP = value added in the project
 VAP' = value added backwards
 VAP'' = value added forwards
 CP = the opportunity cost of the project's input
 CP' = opportunity cost required to obtain the value added forwards
 r = relation between market price and opportunity cost of the items used
 i = input complex

Since the entire useful life of the project is under consideration, formula of equivalence (in terms of present worth or equivalent annual value) has to be applied for the net value added and the operating costs, in the same manner as demonstrated in 3. e. above.

5. Combined Criteria.

a. The Stanford Research Institute's criteria for industrial projects.¹ This deals with manufacturing industries only and assumes that problems of basic services (power, transport, etc.) are already solved. It consists of two steps:

(1) Select "candidate industries"--This is based on the study of demand, availability of resources or inputs, size of market, and site factors.

(2) Determine the qualifications of candidate industries. The authors admit that it is impossible to provide formula for solving the priority problem or to make accurate calculation. Instead, they use some kind of tabulation to compare the qualifications of candidate industries so as to assist in the formation of an opinion. The criteria or tests used include quantitative as well as qualitative ones:

Net return--The ratio between industrial production value and the input it requires. Here, social profitability (eliminating subsidies, taxes, and tariffs, and using opportunity costs) is considered far more important than private profitability as a criterion for priority.

Integrated development--Possible integration with other industries in industrial development.

¹ Stanford Research Institute, Manual of Industrial Development, with Special Application to Latin America, prepared for the Institute of Inter American Affairs, FOA, United States Government, October, 1954.

Stability and growth prospects of the industrial project.

Balance-of-payments effects--Including all positive and negative effects as discussed in 3. e. above.

Socio-economic desirability--Advantages that the industry may offer to the surrounding community.

b. K. A. Bohr's criterion for selecting manufacturing industries.¹ The suggested order of priority consists of four partial evaluation criteria:

(1) Capital requirement--This is expressed as the fixed capital/value added ratio, or capital coefficient. Lower ratio means higher priority, but it is difficult to obtain uniform capital coefficient for the same industry due to the fact that such ratios vary widely from country to country.

(2) Skilled labor requirement--This is measured by percentages of professional technicians, skilled workers, and foremen in total labor force.

(3) Location--The distribution of industries in developing countries should be such as to be able to take the advantage of transport costs. This is measured by a "localization coefficient." The greater the coefficient,

¹K. A. Bohr, "Investment Criteria for Manufacturing Industries in Under-developed Countries," The Review of Economics and Statistics, May, 1954, pp. 157-166.

the more highly concentrated geographically will the industry be.

(4) Predominant size of plant in the industry--The plant in each industry needs a certain minimum scale for economic operation. According to this criterion, industries where smaller plants predominate will have higher priority.

The industries under comparison will then be ranked according their advantages and disadvantages in terms of the above factors, each allotted a certain classification coefficient. The lower the numerical classification coefficient, the more favorable the characteristics of the industry will be and the higher, therefore, its priority.

Here again there is no formula for calculating a single priority coefficient. Only the favorable and unfavorable factors are compared in each specific case.

V. SOME NATIONAL EXPERIENCES AND CONCLUSION

1. The Philippines Industrial Project Formula.

A modified version of the SMP formula has been actually used in the Philippines for the determination of industrial projects.¹ The purpose is to compare investment projects according to the ratio of benefits to costs, both in the direct sense. The benefits include: (1) net value added to national income by factors of production, corrected by an "essentiality factor" to reflect effects of the project on external economies and income distribution; (2) net impact on balance of payments position; (3) net contribution to employment of local labor; and (4) the additional economic values derived from the use of domestic raw materials and supplies. The costs include only capital and foreign exchange required by the project in fixed capital and circulating capital. Both the annual benefits and annual costs are expressed in local currency (pesos).

The formula is as follows:

$$IP = R_1 + R_2 + R_3 + R_4$$

¹ See Philippines National Economic Council, The Five-Year Economic and Social Development Program for Fiscal Years 1957-1961, Manila, 1957. Also, Higgins, Economic Development, pp. 653-662 and pp. 682-686.

Where

- IP = Industrial project;
 R_1 = Net value added to national income, corrected by an essentiality factor;
 R_2 = Net balance of payments effects;
 R_3 = Premium accorded to the use of domestic raw materials and supplies;
 R_4 = Net contribution to employment of local workers.

a. The net value added is equal to the sum of payments to factors of production, excluding that part remitted abroad by foreign owners of factors of production. In the form of a formula:

$$R_1 = \frac{e(w + r + i + p)}{K}$$

Where

- e = Essentiality factor determined according to (1) economic importance of the product, (2) source of raw materials and supplies used, (3) source of capital equipment, and (4) source and nationality of financing.
w = Compensation of all officials, employees, and laborers.
r = Rent for the use of land (8%), buildings (12%), and machinery and equipment (16%).
i = Interest paid for borrowed capital (actual or 6% when not known).
p = Profits or returns on paid-up capital (15%).
K = Total investment in the firm, fixed assets plus circulating capital.

b. The net impact on balance of payments position is measured by the difference between foreign exchange earned or saved and operating costs in foreign exchange, both converted into peso equivalents. Domestic intermediate product

with an import content exceeding 50% of the cost of the product must deduct from its value the import cost. The formula for this net impact is as follows:

$$R_2 = \frac{F.E. e/s - F.E. c}{K}$$

c. The additional economic values derived from the use of domestic raw materials and supplies is measured by:

$$R_3 = \frac{0.5 \times rmd/rmt \times rmd}{K}$$

Where

rmd = Value of domestic materials and supplies used in production, excluding the value of the import content of domestic intermediate product that exceeds 50% of the value of that product.

rmt = Value of the total raw materials and supplies used.

$0.5 \times rmd/rmt$ = the coefficient measuring additional economic value generated by the utilization of the domestic materials and supplies.

d. The net contribution to employment is measured by the number of Filipino workers paid at a uniform average of 2,000 pesos per annum (300 working days). The formula is:

$$R_4 = \frac{ld \times 2,000}{K}$$

Where

ld = Number of Filipino workers employed during at least 300 days a year.

e. The problem of social pricing. In the calculation of benefits and costs ratio, the net value added is arrived at by eliminating taxes, subsidies, and tariffs as discussed before, but no equilibrium price is applied for foreign

exchange. The social pricing of labor, raw materials, and the "essentiality factor" is as follows:

Labor--Only unemployed workers are included, as their social cost would then be zero and is not reflected in the net value added.

Raw materials--If the raw material in question is in excess supply and is expected to remain so (i.e., the resources producing it cannot possibly be used elsewhere), then it will be accorded a premium and included in the formula, because its social cost would be zero. If it is in short supply and will remain so, it should not be included as a positive factor, but should be deducted in full from value added. Other cases between these two extremes may be dealt with by deducting the cost of the material in question from value added at a figure lower than its market price. It is to be pointed out that this premium is also implied in the essentiality factor.

Essentiality--This is evaluated by rating each of the four determinants of essentiality with accounting points ranging from 0.5 to 2.5. The point rating list is shown below:

Table 5.1. Essentiality Rating

Criterion	Points allowed				
	2.5	2.0	1.5	1.0	0.5
1A. Economic importance as an export product	Largely in finished form	Partly semi-finished, partly finished	Largely semi-finished	Partly semi-finished, partly in raw form	Largely in raw form
1B. Economic importance as product for domestic use	Largely used by other industries	Partly for other industries, partly for consumption	Largely for basic human needs	Partly for less essential needs	Largely luxurious or unessential
2. Materials and supplies used	Largely from domestic sources	Partly imported, partly in domestic raw form	Partly imported, partly domestic	Largely imported in raw and semi-finished form	Largely imported in finished and semi-finished form
3. Capital equipment	Entirely locally fabricated	Largely locally fabricated	Partly imported, partly locally fabricated	Largely imported	Entirely imported
4. Source of financing	Entirely national, over 50% paid up	Entirely national, less than 50% paid up	Largely national, partly foreign	Partly national, largely foreign	Entirely foreign

Source: Philippines National Economic Council, The Five-Year Economic and Social Development Program for Fiscal Years 1957-1961, Manila, 1957.

2. The Experience in Taiwan.

While the Philippine formula is somewhat sophisticated (in fact, it is the only country in ECAFE area attempting at quantification of investment criteria by using a formula), Taiwan's approach is very practical. The economic development of Taiwan in the past ten years followed a normal path of development by stages, each stage paving the way for the next. The policy is aimed at non-spectacular but steady growth, giving equal emphasis to agriculture and industry. In the development of industry, light industries come first, heavy, capital goods industries come later. And all the while, power and transport have been kept developing and expanding so that power has now become one of the important local advantages comparable to labor!

This trend of development may be seen from the distribution of gross fixed capital formation in the following table:

Table 5.2. Taiwan's Gross Fixed Capital Formation, 1952-1958

Sector	unit: NT\$ million						
	Year						
	1952	1953	1954	1955	1956	1957	1958
Agriculture (including Forestry & Fishing)	566	689	707	848	872	938	1,119
Manufacturing	341	543	493	839	974	1,335	1,773
Power (including gas and water supply)	218	177	397	586	558	704	971
Transport & Communications	311	362	253	270	464	721	952

Public administra- tion	160	170	203	181	310	572	659
Mining	21	13	15	27	46	96	94
Commerce	171	265	287	285	214	108	93
Others	231	321	382	471	569	570	720
Total	2,019	2,540	2,737	3,487	4,007	5,044	6,381

Source: Directorate-General of Budget, Accounts, and Statistics, Executive Yuan, Republic of China.

The basic factors in investment decision-making are: capital, external economies, market demand, balance of payments, and employment. Priorities for investment were formulated in general terms at each stage of development, which may be briefly stated as follows:

a. The stabilization period (1949-1952)--Agriculture received greatest attention due to the urgent food demand arising from the sudden inflow of about two million mainlanders to Taiwan (about one-third of the then Taiwan's population). Besides a vigorous and successful land tenure reform program, great emphasis was laid on irrigation, fertilizer, and farming techniques. On the industrial side, high priorities were given to three "key industries:" power and transport, chemical fertilizers, and textiles. The development of fertilizer industry was aimed at utilizing local materials and substituting imports which then constituted about 15% of total imports. The development of the cotton textiles industry was rather spectacular: production increased by 4.4 times from 1949 to 1953. But

this was the industry in which China had fairly good experience and facilities. The major thing lacking was raw material (cotton), and this was provided for under the U.S. aid commodity imports program.

b. The First Four-Year Development Plan period (1953-1956). After stabilizing the economy, a four-year economic development plan was formulated.¹ It was mainly an investment budget consisting of production goals for major agricultural and industrial products. The aim is to increase domestic production in order to meet the increasing local demand and to reduce the balance of payments deficits. Besides agricultural production and power and transport, top priorities were also given to import-substituting industries (fertilizer, textiles, oil refining, cement, chemicals) and medium and small size industries (light or consumer goods industries and handicrafts). In short, the emphasis was to broaden the base of domestic production and to substitute consumer goods imports as far as possible.

It is to be pointed out that during this period, protection and other incentive measures were applied rather extensively.

3. The Second Four-Year Development Plan period (1957-1960).

The chief objectives envisaged by the Second Four-Year

¹ Republic of China, Economic Stabilization Board, The First Four-Year Economic Development Plan, Taipei, 1954 (mimeographed).

Plan¹ are to raise national income (6-8% per annum), increase employment opportunities, expand exports, and further reduce international payments deficits. The general path of development is mainly a continuation of the First Plan, but with greater emphasis on export industries and the starting of some heavy industries. It was envisaged that a small-sized economy like Taiwan, which is lacking in industrial materials and which has an easily saturated market, needs to have a substantial export sector in order to increase its capacity to import and to enlarge its market for continued and expanded production. Already high priority has been given to industries which utilize local materials for producing export goods (or import substitutes). But they are mainly industries processing agricultural products. Now, new export lines are vigorously promoted which either utilize local materials or imported materials. Industries utilizing imported crude oil, cotton, aluminum ore and iron ore have already been well established. New lines of production utilizing imported raw materials and processing them for export are promoted with great effort. The purpose is to diversify the export base and to make the best use of local advantages in labor and power. This is, of course, a very

¹ Republic of China, Economic Stabilization Board, The Second Four-Year Economic Development Plan, Taipei, 1957 (mimeographed).

difficult field, because it not only involves the problem of quality and cost of the export product, but also the foreign trade policies of other countries.

The establishment of new heavy capital-goods industries is undertaken with extreme caution. For this involves huge capital and entails great risk and waste, and unless the adequacy of raw materials supply and market demand is ensured, it is not economical to develop such industries. Perhaps this is the problem with most of the developing countries of relatively small size. Here the need for regional cooperation is urgent. The new line of heavy industries tried include a Sino-American joint shipbuilding undertaking (the Ingalls-Taiwan Co.) which was established in 1957 and which has built two 36,000-ton tankers, a private automobile works with technical cooperation from Japan, and a proposed 200,000-ton capacity integrated iron and steel plant which is still pending decision due to difficulties in regional cooperation.

Besides, a multi-purpose water resources development project (the Shimen Reservoir Project) was also undertaken which would involve a total cost of \$72 million. The Plan also stressed the need of improving the productivity and making full utilization of the capacity of existing plants, as this is considered of equal importance as the establishment of new plants.

Taiwan's economic development in the past can be said to be fairly successful when judged from the fact that real national income increased 34% during the First Plan period (or 8% per annum) and 18% during the first three years of the Second Plan period (or about 6% per annum). But two underlying facts should be pointed out. The first is the important role played by U.S. aid. It is estimated that U.S. aid contributions to Taiwan's gross fixed capital formation range from 20% to 30% during the period 1953-1957.¹ Secondly, the rapid population increase during 1953-1959 at an exceedingly high rate of 3.7% per annum resulted in a mere 2% per annum increase in real income per capita for the same period. Here is a case in which no rate of investment that is practically attainable will guarantee sustained economic progress, unless a positive population policy is adopted.

The economic development in Taiwan and in the Philippines have certain common characteristics of which it may be interesting to make a brief comparison.

3. Taiwan and the Philippines Compared.

a. The problem of maintaining relatively high rate of growth. Both Taiwan and the Philippines achieved relatively

¹ Republic of China, Council for United States Aid, Executive Yuan, Report on Utilization of United States Economic Aid in Taiwan, Taipei, February, 1959 (mimeographed).

high rate of growth in the past: Taiwan witnessed 8% per annum during 1953-1956 while the Philippines witnessed more than 5% per annum during 1950-1956. This high rate is chiefly a result of the favorable capital/output ratio. In Taiwan, the average capital/output ratio during the First Plan period was about 1.2, as investments were made chiefly in agricultural improvement and light industries. In the Philippines, the capital/output ratio was as low as 0.67 during 1950-1954, because it was a period of rehabilitation and reconstruction and because its national accounts underestimated gross investment in several aspects. But as development goes on, these favorable circumstances will no longer be available. In recognition of this, the Philippine program has set the target rate of income growth at 6% per annum, about the same as in the past, assuming a capital/output ratio of 2. The Second Plan of Taiwan even lowered its target rate of growth from 8% to 6-8% per annum. It has now gradually become clear that these "modest" rates have yet to be achieved by greater efforts.

b. The problem of increasing the rate of net investment.

The rate of net investment in both countries has not grown to the extent required to attain the target rate of growth. In the Philippines, there is considerable inequality in income distribution, but this inequality has not given rise

to high rate of savings and investment.¹ In Taiwan, fairly even distribution plus the political consideration of showing consumers' freedom to the Communist-controlled mainland made it very difficult to curtail the people's marginal propensity to consume. Here, fiscal policy has a more positive role to play and the Philippines, with its higher per capita income and richer resources, is in a better position to effect a higher rate of savings and investment.

c. Balance of payments and export possibilities. The two countries have persistent import surplus, covered by U.S. aid. Both depend on a few traditional agricultural products as the major foreign exchange earner. In the case of Taiwan, for example, for every \$1 worth of goods and services imported during the period 1951-1957, it could pay only \$0.60 on the average. The balance of payments deficits are caused by many factors: fluctuations in export sales proceeds, increasing need for investment goods and raw materials, and "living beyond one's means" in consumption. From the viewpoint of investment criteria, top priority should be given to new lines of export, that is, industrial exports. This is being pushed hard in Taiwan, but the task is conceivably a very difficult one.

¹For example, in 1954, national income going to entrepreneurs and property owners accounted for 56%. Savings and investment from these sources ran only 4-5% of national income during 1950-1956.

d. Unemployment or underemployment. This has been more serious in the Philippines although the seriousness may be subject to different interpretations. Both give high priority to projects that create more employment opportunities. But the rate of new job creation has been small compared with the number of unemployed. The Philippines National Economic Council estimated in 1956 that the unemployed were about 20% of the total labor force. Even with optimistic estimates of employment creation it would take thirty years of investment at the planned level to eliminate unemployment!

4. Concluding Remarks.

The above is but a sketch of some of the development problems in island-type economies where it is evident that growth depends heavily upon development of export industries. Although it is true that the problems faced by developing countries may be more or less the same problems, there have not yet been any uniform answer(s) for their solution. It depends on the internal as well as external conditions of the particular country in question. It also depends on the stage of development already achieved. The discussion in IV. 2. may have brought some clues to the problem, but it is quite beyond the scope of the present paper to elaborate on them.

To return to investment criteria. It is clear from all the foregoing that no matter how many aspects are involved in the problem of investment decision, and no matter what

criteria is applied, the following two basic points should be kept in mind in any formulation of an investment program:

First, the subjective element in investment decisions. Allocation of resources among alternative uses must be based on the freely expressed preferences of consumers. All the strivings to raise income per capita are aimed ultimately at the widening of the range of choices so that the people can enjoy a higher standard of living. The problem is, at what speed is the rate of investment to take place in order to raise income. This depends partly on a subjective evaluation of the social and political setting and the organizing ability of the country concerned. Another problem is into which direction(s) should the resources be put in order to best serve the ultimate aim of consumption. Ideally, investment should be distributed among the various industries exactly as people's income is distributed among the various goods and services demanded. This would result in a harmonious program which can be worked out through the instruments of accounting prices and SMP as elaborated in IV, 3. and 4. Actually, the distribution of investment will depend on the main economic facts of the country as well as on the subjective judgement of the planning authority as to what should the composition of goods and services look like.

Second, the interdependence of investment decisions. No matter what criteria to be applied and what composition of

output to be had, the actual investment will be conditioned by the inter-industrial relationships to some extent, and the subjective elements stated above will have to reconcile to the dictates of these relationships. This is the more so, the more the advanced production technology is applied. Perhaps, then, the availability of more knowledge and data about these relationships would facilitate the determination of investment in developing countries. And it is in this sense that investment criteria in the context of overall programming has more significance.

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