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INVESTMENT VERSUS ECONOMIC GROWTH

by

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Investment versus Economic Growth

In classical economic thinking, which was shaped in reaction to the British industrial revolution of a century to two centuries ago, labor was considered a factor of production whose productive powers can be increased primarily through specialization and the use of more capital, rather than through an increase in labor's own capacity and incentives. Labor was conventionally looked on as undifferentiated work power, and conspicuous socio-economic classes received income flows that could be roughly identified with wages, profits and rents.

The traditional emphasis is represented today in variants on the form $P = f(T, L, K)$, where T is a measure of productivity of all inputs, L is quantity of labor, and K quantity of capital. Natural resources (the classical "land") are taken for granted or included in capital. Variants on the model introduce time lags, divide capital and labor into their varieties, reason about substitution possibilities, and analyze dynamic sequences. The focus of attention remains on increasing one or more of these three determinants of production, among them especially capital, seen as more amenable to policy influences than the others. Growth in production is often visualized as the outcome of a saving rate and a fairly stable aggregate capital-output ratio.

The prominence of the orthodox growth analysis has been supported and increased in the past thirty years by under-employment analyses, Keynesian and variants, that determine the level of employment through savings-investment interactions, and by their evolution into Harrod-Domar growth theory. The traditional savings-tangible-investment growth model seems clearly dominant today, despite minority views. A survey of the two economic journals that are probably most read and influential, the

American Economic Review and the Economic Journal, for their eight regular issues of 1964 and 1965, finds that 27 out of 42 articles, notes and communications dealing with economic growth, or nearly two-thirds, follow this line of reasoning.¹ In the Abramovitz survey of the "Economics of Growth" for the American Economic Association Anthology of 1952² almost two-thirds of the total space is given over to capital formation as a cause of economic growth.³ Capital is usually defined in physical terms, with social factors entered as influences on the rate of accumulation of such capital and the efficiency of its use. In the remarkable survey by Hahn and Matthews, "The Theory of Economic Growth",⁴ 43 of 72 relevant pages or over half, are devoted to savings-investment causes of income change.

The traditional dominant view is currently being subjected to qualification and criticism, the more vigorous because of concern with the

	<u>AER</u>	<u>EJ</u>	<u>Total</u>
¹ Total of articles, notes and communications published in 1964 and 1965.....	93	99	192
--Of these, on growth economics.....	12	30	42
--Of these, investment-as-a-cause-of growth approaches.....	9	18	27
Other approaches.....	3	12	15

Growth economics took up a smaller proportion of the AER's total than of the EJ's: 13% as compared to 30%; but of these, investment-as-a-cause-of-growth took up a larger proportion, 75% as compared to 60%.

There were in both journals borderline approaches hard to classify. Minor comments and replies were excluded from the count of both journals. The Proceedings of the American Economic Association were also excluded.

²B.F. Haley, ed., A Survey of Contemporary Economics, Vol. II, M. Abramovitz, "Economics of Growth" (Homewood: Richard Irwin, 1952), pp. 132-178.

³Even though Harrod-Domar theories are excluded as making no assertion about the probable actual development of an economy over time, p. 170, Note.

⁴Economic Journal (December 1964), pp. 779-902.

growth problems of less developed countries. (a) Aspects of the first qualification were built in from the beginning: "Technology" can change. There may be economies of scale, improved organization of production, new types of capital goods. These improvements may or may not be Schumpeterian innovations, and they may or may not be embodied in new capital equipment, or alter the relative demand for factors.

(b) Second, there is uneasiness over the relative importance of the savings-tangible-investment approach to problems of economic growth. Solow, a notable practitioner of that approach, generalizes, after exploring one standard kind of model:

"Investment is at best a necessary condition for growth, surely not a sufficient condition. Recent study has indicated the importance of such activities as research, education, and public health..."⁵

Hahn and Matthews, at the end of their survey, suggest that refined analysis of an economic system in which one of the inputs is durable capital goods:

"...(may have reached) the point of diminishing returns. Nothing is easier than to ring the changes on more and more complicated models, without bringing in any really new ideas and without bringing the theory any nearer to casting light on the causes of the wealth of nations... It is essentially a frivolous occupation to take a chain with links of very uneven strength, and devote one's energies to strengthening and polishing the links that are already relatively strong."⁶

⁵Robert M. Solow, "Technical Progress, Capital Formation, and Economic Growth," American Economic Review, Papers and Proceedings (May, 1962), p. 86.

⁶Op. cit., p. 890. They recommend two lines of inquiry for more attention in the future: the motivations of economic agents, avoiding "the twin dangers of empty formalism and inconclusive anecdote"; and the concept of "the world as a whole as an underdeveloped economy" (pp. 890-91).

Among economists concerned mainly with growth problems of less developed countries, the traditional model is well represented. Nurkse's position was nearly unqualified: "The country's incremental saving ratio...

6 (continued)

is the crucial determinant of growth". (Problems of Capital Formation in Underdeveloped Countries (New York: Oxford Press, 1953), p. 142.)

The United Nations ECAFE experts in their 1960 Report on Programming Techniques for Economic Development judge "The final goal of development planning is...to find the best way of breaking the vicious circle between capital shortage and under-development and to design the most efficient and optimum rate of capital accumulation. Capital accumulation may very well be regarded as the core process..." (E/CN.11/535, p. 8.) Gunnar Myrdal, often unconventional, recommends for development "a policy of the utmost austerity...to hold down the level of consumption in the degree necessary for rapid development". Economic Theory and the Underdeveloped Regions (London: Methuen, 1957), pp. 82-83. Rostow presents as a necessary but not sufficient condition for take-off the rise of the share of net investment in national income "from (say) 5 percent to over 10 percent". (The Stages of Economic Growth (Cambridge: Cambridge Press, 1964), p. 37.)

On the other hand, Arthur Lewis disavows (in conversation) savings and investment as holding the critical place in economic growth, though his writings often give strong support to the conventional analysis. Bauer and Yamey write "It is often nearer the truth to say that capital is created in the process of development than that development is a function of capital accumulation", The Economics of Underdeveloped Countries (Cambridge: Nisbet and Cambridge, 1957), p. 127. Myint emphasizes the complex of factors that limit the capacity of a country to invest its saving productively, The Economics of the Developing Countries (London: Hutchinson, 1964), pp. 15-17. Lauchlin Currie enters a vigorous dissent to preoccupation with investment as a priority condition for economic advance: Accelerating Development (New York: McGraw-Hill, 1966). A.K. Cairncross in several papers, notably "The Place of Capital in Economic Progress," reprinted in his Factors in Economic Development (London: Allen and Unwin, 1962), questions the priority of capital as a cause of economic growth. S. Herbert Frankel analyzes the constraints on the possible contributions of capital: The Economic Impact of Under-Developed Societies (New York: Oxford University Press, 1953), pp. 67-79. See below, Section IV.

V.K.R.V. Rao, Director of the Institute of Economic Growth in New Delhi is a notable spokesman in the less-developed world for the traditional austerity-investment road to growth. He brings together data from the U.K., U.S., and other present high income countries, on experience during their earlier growth periods of a high proportion of women and children in the factories, a long work week, repression of unions, and denial of vote to labor. He judges that political democracy is the enemy of economic growth; if the worker had won political freedom earlier, he could have prevented economic development either from taking place at all, or certainly from taking place at his own expense. Robert M. Hutchins presents a simplified version of the doctrine in U.S. newspapers:

"Since the worker will spend any money he can lay his hands on, whereas the employer, whether he is a capitalist or the Communist party, will save and invest, the thing to do is to use cheap labor, work it long and hard, and deprive it of any considerable share of the fruits of economic advance."

(Column of July 1, 1966).

The preoccupation of the economics profession with non-human material capital as the critical determinant of economic growth has had its influence on policy. Development planners in less-developed countries have been encouraged to focus their attention on investment for capital goods, and as the best proxy for that, on expenditure targets for investment. The practical developers of the International Bank complain:

"Because some governments consider investment virtually synonymous with development, they have emphasized the fulfillment of the financial investment targets in their plans rather than the physical output targets that the investments are aimed at achieving. They have sometimes seemed to act as though the attainment of production targets follow automatically, or with minor additional effort, the realization of financial investment targets."⁷

If qualifications on the capital goods approach to economic growth are modest, then that approach is justified and economic analysis can seek efficiently to integrate the basic model and the qualifications. But if the qualifications dominate the set of causes, then traditional analysis is misleading and policy prescriptions may be perverse. Instead of the classical prescription on checking consumption increase or even cutting consumption, to the end of raising the supply of capital goods, perhaps certain kinds of consumption should be expanded--those

⁷ Albert Waterston, Development Planning: Lessons of Experience (Baltimore: Johns Hopkins Press, 1965), p. 299.

Reddaway reminds Indian planners:

"Capital expenditures are a very important means of helping to attain these outputs but they are not an objective in themselves. If some other plan of raising output could be discovered during the plan period (e.g., by the use of better seeds instead of costly irrigation schemes), then the essence of the plan would be fulfilled even if the capital expenditures were far below the original figures".

W.B. Reddaway, "Importance of Time Lags for Economic Planning", Economic Weekly, Bombay (January, 1960), p. 227; in Waterston, op. cit., p. 299. Galbraith also complains of a mistaken emphasis on non-human material investment as synonymous with development: "... (steel mills, dams, and fertilizer factories)... get the discussion, the money, the visitors, the glow of pride". (J.K. Galbraith, Economic Development in Perspective (Cambridge: Harvard University Press, 1962), pp. 51-52.)

that promise the optimum combination of present satisfaction with promise of future productivity rise through health and energy, training and incentive effects.

This paper is concerned with the empirical and logical relation of investment to income changes. Section II, following, considers definitions of investment; Section III, empirical evidence on the correlation of investment with income changes; IV, investment-income growth relationships, including the extent to which investment by any definition is not a contributor to income growth, but is instead a burden on, or a result of changes in production; and consumption or organization causes of growth. V is the conclusion.

II

A. One can define any activity that adds to tomorrow's potential income as investment, and the product of such activity, whether material or non-material, as capital. So Schultz, among others, adds to traditional capital concepts that of "Investment in Human Capital".⁸ Part of such investment is what would ordinarily be called consumption.

This most general definition is tautologous: it cannot possibly be wrong.

⁸"Investment in human capital is probably the major explanation for growth of national output.

Much of what we call consumption constitutes investment in human capital. Direct expenditures on education, health, and internal migration to take advantage of better job opportunities are clear examples. Earnings foregone by mature students attending school and by workers acquiring on-the-job-training are equally clear examples... The use of leisure time to improve skills and knowledge is widespread, and it too is unrecorded."

Theodore Schultz, Presidential Address at the American Economic Association Meeting, December 28, 1960, in the American Economic Review (March, 1961), pp. 1-15.

John Vaizey, commenting on "the present apparent imbalance in economic theory", asks whether we are moving "Towards a New Political Economy", emphasizing human resource problems. In the Residual Factor and Economic Growth, Study Group in the Economics of Education, Organization for Economic Cooperation and Development, Paris, 1964, p. 201.

But it will often be misunderstood to refer to things traditionally called capital; that is non-human material capital.

Acceptance of a general concept of capital implies that in addition to material capital, (1) the traditional capital goods and (2) the newer human capital, there is also non-material capital, embodied currently neither in things nor in people: (3a) non-material producers' capital, the social organization for developing and maintaining the conditions for effective production, including law and order, the discovery and dissemination of technical knowledge, and the maturing of social values congenial to efficient production; and (3b) non-material consumers' capital, the social relationships that give meaning and satisfaction to many kinds of consumption and in some measure to all consumption.⁹

The generalized notion of capital inherits a respectable minority tradition in economic thought. Irving Fisher developed such a concept in detail,¹⁰ winning Marshall completely to it from the abstract and

⁹ Harry Johnson suggests that non-material capital, embodied in neither human nor non-human forms, consists of "the state of the arts (the intellectual production capital of society) and the state of culture (the intellectual consumption capital of society)". In The Residual Factor and Economic Growth, op. cit., pp. 219-225. This division seems awkward, in that the state of the arts and of culture must be embodied in either human beings or in recorded materials. And yet there is a non-material background and requisite for production and consumption. The above is an attempt at separating it out.

Pigou emphasized the "current stock of ideas" as occupying a dominant place among productive resources. A.C. Pigou, Income (London: Macmillan, 1949), p. 19. Among others, Slichter depicted knowledge embodied in increased energy availability, improved arts of management, and technological research as fundamental causes of economic growth. Sumner H. Slichter, Economic Growth in the United States (New Orleans: Louisiana State University Press, 1961), pp. 74-83.

¹⁰ In his fullest statement, he defined wealth as "material objects owned by human beings", which consists of land, land improvements, and commodities, plus human beings (freemen possess their own productive capacity). His earlier articles in the Economic Journal and the Quarterly Journal of Economics are summarized and developed in The Nature of Capital and Income (New York: Macmillan, 1927).

mathematical point of view. It lost out, thought Marshall, only because it was not "in touch with the language of the market".¹¹ Knight was sympathetic to the abstract concept, emphasizing both heterogeneity within conventional factor categories, and substitutibility across the boundaries.¹² Schultz, Becker, Sjaastad, Mushkin and others have shown the fruitfulness of the generalized approach in human capital analysis.¹³

B. In contrast, Hicks defines a person's income, and according to Samuelson properly does so, as the maximum he can consume without shrinking his future consumption. The definition is usually interpreted, and Hicks himself did so, as meaning that income is consumption plus capital accumulation.¹⁴

But if kinds of capital other than capital goods are important, and

¹¹Principles of Economics, Eighth edition (London: Macmillan, 1936), pp. 787, 788. Marshall's objection has less force if the aim is not, as his was, to explain "mankind in the ordinary business of life", but to explore the conditions for economic advance. Fisher took issue with Marshall on his own ground: op. cit., pp. 61-64.

¹²Frank H. Knight, Risk, Uncertainty and Profit (Boston: Houghton Mifflin, 1921), pp. 123-140.

¹³Theodore W. Schultz and others, "Investment in Human Beings", Journal of Political Economy, Supplement (October, 1962). Knight goes to some pains to argue against "commonly assumed grounds of distinction between labor and property services", op. cit., pp. 126-129.

¹⁴J.R. Hicks, Value and Capital (Oxford: Oxford University Press, 1939), pp. 171-184, especially pp. 176-177. P.A. Samuelson, Foundations of Economic Analysis (Cambridge: Harvard University Press, 1948), pp. 353-54; R.M. Solow, op. cit., p. 43.

Hicks did not much like even the best qualified version of his definition: "We shall be well advised to eschew income and savings in economic dynamics." His objections were technical ones: the difficulty of measuring real income over time, the complications introduced by durable consumer goods, the incommensurability of choices made at the beginning of one week with those made at the beginning of the next, and inconsistency in people's expectations and plans. He finally came to an ex post kind of income ("consumption plus capital accumulation") which satisfied him for limited purposes, only by explicitly leaving out the cumulation or dissipation of human capital (pp. 178-179).

may be of major importance, as many growth economists are now arguing, then the theoretical boxes should take account of the fact, and conventional divisions of income, consumption, and investment become still more awkward than Hicks saw them.

Ex post, the produced heap of income can always be divided into two piles, labelled "consumption" and "investment", whose sum equals the original total. But suppose instead that we follow fairly conventional concepts: income is consumption plus investment; consumption as what gives satisfaction (by some definition) to people; investment as what contributes to their future potential income. Then income is made up of piles that must be double-counted: (a) simple consumption, (b) consumption that is also capital accumulation (investment), and (c) non-human material capital formation and non-material capital formation (investment). Consumption is a plus b; capital formation or investment is b plus c. The total of consumption plus investment (a + b + b + c) is greater than income. The total of simple consumption and saving (a plus c) is less than income.¹⁵

Simple and convenient points of logic, like Samuelson's that "An economy whose consumption potential is rising cannot be consuming all its income",¹⁶ become in this more realistic framework, simply wrong.

C. The low-brow and practical definitions, which automatically come to mind, are the national accounts concepts. Income is consumption (including a portion of government real outlay) plus investment. Gross

¹⁵--Or else consumption and saving add to greater than income, if by main force and some illogic, b is called saving as well as consumption.

¹⁶Quoted in Solow, op. cit., p. 43.

investment in (following fairly standard definitions): (a) newly produced durable goods (those with an average life exceeding one year) acquired by their ultimate business users, including new residence construction (since home-owning is treated as a business); plus (b) change in business inventories valued at current replacement cost. (c) Government investment is often estimated separately. The total of a, b, and c is domestic investment. There may be some convenience from adding in (d) foreign investment, which is the excess of exports of goods and services (domestic output sold abroad and production abroad for which payments are due to domestic-owned resources) over imports (domestic purchases of foreign output, domestic production for which payments are due to foreign-owned resources, and net private cash gifts to abroad). If one is courageous, he may subtract an estimate for depreciation to get net measures of investment and so of income.

The national accounts concept of income is often misleading for economic growth purposes for two reasons. First, the measured output included even in an ideally accurate GNP omits unmeasured kinds of output, especially those occurring within families and close groups, which have systematic major trends as economic growth proceeds. Second, it takes no explicit account of the distribution pattern of income. It is very possible for measured exports, investment (for a few large firms and by government), and consumption (in the major city or cities) to rise rapidly, while life for the nine-tenths of the people away from a few centers goes on almost identically with its pattern generations ago.¹⁷ Data for the

¹⁷This is what George Dalton, from experience in Liberia, calls "Growth without Development".

commercial and government sectors can be overrepresented in published statistics through omissions of traditional and marginally-social economic activities.

What is the usual practice on the above definitions? Often the practical man, and economists too, mix together definitions B and C. Income is consumption and investment; investment is what contributes to the growth of future potential consumption, whereas consumption does not (definition B); and for purposes of practical policy, investment is identified with the national income concept C, or with some segment of it. But definition B is inaccurate, and the identification of B and C is illicit.

III

A number of studies of aggregative input-output relationships in the United States and the United Kingdom attest to a dominant proportion of changes in output in excess of changes in input of the total quantity of capital and labor.¹⁸

¹⁸ Schmookler finds an average rise of 1.4% a year in output per unit of input, 1904-13 to 1929-38. (Jacob Schmookler, "The Changing Efficiency of the American Economy, Review of Economics and Statistics (August, 1952).) Valavanis-Vail finds a shift upward of about 3/4% a year 1869-1948 in the production function from given inputs. (Stephan Valavanis-Vail, "An Econometric Model of Growth: USA 1869-1953", American Economic Review, Proceedings, pp. 208-22.). Fabricant estimates that 90% of the rise in U.S. output per capita is due to "technical progress" rather than to rises in inputs. (S. Fabricant, Economic Progress and Economic Change (New York: National Bureau of Economic Research, 34th Annual Report, 1954).) Abramovitz, partly drawing on Kendrick, finds in the 75 years, 1869-78 to 1944-53, that U.S. inputs into production per capita rose only 14% while productivity per capita rose 248%, a ratio of 1 to 18. (M. Abramovitz, "Resource and Output Trends in the United States since 1870", American Economic Review, Proceedings (May, 1956), pp. 5ff.) Solow in an aggregative econometric study for the U.S. 1909-48, in which the data are made less heterogeneous by omitting agriculture and government, and assuming that technical and organization advance must be embodied in new capital equipment, still

These studies measure technical progress as a residual: the difference between growth rates of production and of inputs of labor and material capital, the latter measured as real inputs weighted by base period wage rates and capital earnings taken as measures of marginal products. The studies suffer from the wide degree of aggregation involved--no factor is more heterogeneous than labor, though capital has its own claims to

18 (continued)

finds that 90% of the rise in gross output for man hour is not accounted for by changed inputs of land and capital. (R.M. Solow, "Technical Change and the Aggregate Production Function", Review of Economics and Statistics (August, 1957), pp. 312-20; corrected for a computing error later, op. cit., November, 1958.) Massell, using the same procedure on U.S. manufacturing 1919-57, comes out with an identical figure. (Op. cit., May, 1960, pp. 182-188.) Denison, making courageous estimates of the constituents of the "residual" not explained by quantitative inputs, shows changes in real U.S. income 1919-57 originated as follows:

Increase in labor hours.....	27%
Increase in capital.....	15%
Total increase in real inputs.....	42%
Improvement in labor quality.....	26%
Technical and organization advances.....	32%
Total productivity increase.....	58%
	<hr/>
Total....	100%

(E.F. Denison, The Sources of Economic Growth in the United States, etc. (New York: Committee for Economic Development, Supplementary Paper 13), p. 266.) For an earlier period 1909-29, Denison's procedure finds inputs accounting for more than above (57%), and productivity increase for less (43%). Reduaway and Smith, in a study of British manufacturing, 1948-54, find a bit over half of growth due to capital and labor inputs, and almost half (46.7%) to increased productivity. (W.B. Reddaway and A.D. Smith, "Progress in British Manufacturing Industries in the Period 1948-54", Economic Journal (March, 1960), Table I, p. 27.) Aukrust finds, from an econometric study for Norway, 1900-55, that normal improvement in organization and techniques leads to a 1.8% rise in national product a year. A large increment in real capital (9%) is needed to raise output as much; or a considerable rise in employment (2-1/2%). The rate of growth of the economy was not very sensitive to changes in the amount of investment. A study by Niitamo for Finland gives similar results. (Odd Aukrust, "Investment and Economic Growth", Productivity Measurement Review (February, 1959), pp. 35-53. Olavi Niitamo, "Development of Productivity in Finish Industry, 1925-52", op. cit. (November, 1958).)

On the other hand, Griliches finds that "residual" causes of output increase can, in a sample study, be explained by wrong specification, measurement, or weighting of inputs, plus economies of scale. "Wrong specification" includes neglect of quality improvement or labor inputs. (Zvi Griliches, "The Sources of Measured Productivity Growth: United States Agriculture, 1940-60", Journal of Political Economy (August, 1963).)

distinction;¹⁹ and from the assumption that factors are paid their marginal products, that is, that the factor markets are perfectly competitive or behave as if they were.²⁰ They do suggest that the contribution of increased capital to increased output in these economies is likely to be some 10-30% of total contributions, with the lower part of the range more likely.

The international correlation of national income measures of investment and measured growth has been explored for a number of countries over certain post World War II years, by Hill and by his critics Johnson and Chui. All three find the correlation to be poor:

"...the relation between growth and one kind of investment cannot be the same as that between growth and another kind... In so far as any general association exists between growth and investment, it is largely due to investment in machinery and equipment. This is especially the case for growth in GNP per person employed, where all of the correlations, excepting that with machinery and equipment, are quite trivial."²¹

There is some indication in their studies that a high rate of investment may be a necessary condition for growth, though it is clearly not a

¹⁹"There is no reason to suppose that any single object called 'capital' can be defined to sum up in one number a whole range of facts about time lags, gestation periods, inventories of materials, goods in process, and finished commodities, old and new machines of varying durability, and more or less permanent improvements to land." Solow, op. cit., pp. 13-14.

²⁰Other implied assumptions in the approaches are considered in F.H. Hahn and R.C.O. Matthews, op. cit., pp. 833-53.

²¹T.P. Hill, "Growth and Investment According to International Comparisons", Economic Journal (June, 1964), pp. 297-98. The last two sentences are repeated for emphasis in the later "Reply", Economic Journal (September, 1965), p. 631 to a "Comment" by D.W. Johnson and J.S. Chiu, in the same issue. Hill does find a strong correlation between gross investment and GNP growth for the U.S. and the U.K., France, Italy, and Germany 1954-62, but the association weakens when employment is allowed for and smaller countries are included. There might possibly be better correlation if a longer time period were allowed for investment effects to work themselves out.

sufficient condition.²² The more northern countries tend to have high investment rates without particularly rapid growth, interpreted by Hill as due to the demands of their geography and climate for a large volume of construction, which has little effect on measured income increases.²³ Smaller and lower income countries typically show less relationship between investment and income than holds for the five major countries.

The Secretariat of the Economic Commission for Europe has also explored the relation between capital inputs and production increases for 22 Western countries in the 1950's. They conclude there is "practically

²²Johnson and Chiu, op. cit., p. 269; Hill, op. cit., p. 165. This accords with the cautious view of Solow as given in American Economic Review, Proceedings (May, 1962), p. 86.

²³"The demolition of some dismal nineteenth century school and its replacement by a modern, well-designed, and well-equipped building should lead to a real improvement in the quality of education, but the flow of educational services included in GNP is unchanged in these circumstances". Hill, op. cit., p. 299. Professor David Granick suggests that critical periods in the growth process are likely to be characterized by large shifts in the proportion of measured to unmeasured outputs, and also in the proportion of measured to unmeasured inputs; so that conventional pre-occupation with measured inputs and outputs can readily lose the central significance of what is going on.

Hill suggests: "There is a tendency for construction to be more closely associated with the provision of services than with the production of goods; and vice versa...for machinery. This fact, in conjunction with the known tendency for the growth of output per person in services, especially as conventionally measured, to be much slower than in the production of goods, is probably the basic explanation underlying many of the results of this paper." (p. 303).

As to the relationship Hill suspects is critical, the share of GNP going to machinery and equipment as compared to the share going to construction: there is no correlation between the two for his sample countries and period, no matter whether residential construction is included or excluded (pp. 296, 320).

no correlation" between investment ratios and growth rates.²⁴

Low correlation does not disprove the existence of causation, nor would high correlation prove it. What is proved is that any causation between conventional investment and measured income growth was (in these countries, for these periods of time, and granting the data are reasonably accurate) relatively unimportant compared to other influences.

In the special form of the marginal capital-output ratio (dK/dO) or MKOR) the relationship of (net or gross) material investment to production changes has had much attention. MKOR's cannot be used for setting priorities, since they make no allowance either for the durability of the capital used, nor the complementary inputs required of labor and supplies. But they can sometimes be useful for roughly estimating the capital requirements of a given project or set of projects.

The dK to dO ratios will vary by level of technology and by resource-price variations, which means from one economy to another (within a range)²⁵

²⁴For all 22 countries, the correlation coefficient is .2. When, to obtain more homogeneity, they select out the 13 most industrialized countries, the correlation is nearly as low. If Norway, an extreme deviant, is also omitted, the correlation coefficient rises to .69.

Investment ratios and growth rates are the average annual ratios, 1949-59. Four low growth rate countries (Denmark, Norway, Sweden, the U.S., about 3-1/3%) show a wide range of investment ratios (18 to 33%) including the highest; and four high growth countries (Austria, Greece, Italy, Turkey, about 6%) have relatively low investment ratios (15 to 23%). United Nations, Some Factors in European Economic Growth during the 1950's, Geneva, 1964, p. 18.

Suits has made a diligent and unsuccessful attempt to relate investment to income growth in the Greek economy: Daniel B. Suits, An Econometric Model of the Greek Economy (Athens: Center of Economic Research, 1965).

²⁵Simon Kuznets, "Capital Formation Proportions, etc.", Economic Development and Cultural Change (July, 1960), Part II, pp. 43-68. U.S. Department of State, "Intelligence Report No. 7670", Washington, D.C., 1958.

of at least 4 to 1); from one industry to another within an economy (within a range of 100 to 1 or more); and in consequence of these causes, from one period of time to another (by decade averages, within a range of 2-1/2 to 1 or more). Some of the variations can be explained plausibly, and so be allowed for in planning.

IV

This section consists of a fairly concrete listing of cases in which the conventional argument that non-human material investment causes income changes fails; and in which other causes of income changes are central.

A. The case for income changes caused by such investment is straightforward: the under-employment investment multiplier is irrelevant to it. Production rises (dO) because of improved proportions (dK) in the production mix, or because better performance is embodied in the replaced or added capital. On the dK -to- dO relationship a vast and subtle literature is based, much of it surveyed up to recently in the Hahn and Matthews article.

MKOR's have been supposed to measure this causation. But it turns out that they do not do so, even in theory. If other than conventional capital inputs normally dominate the causes of income change, for which the evidence is overwhelming, then empirical MKOR's are an inverse function of the rate of growth (and not a measure of the contribution of capital to growth). We modify slightly Leibenstein's demonstration of the relationship: Take a standard Cobb-Douglas production function in which non-human and non-material inputs are explicit:

$$dO = a + b dK + c(dH, dN)$$

and
$$MKOR = \frac{dK}{dO} = \frac{dK}{a + b dK + c(dH, dN)}$$

As above, dO is the increment in output, dK that of capital, dH and dN increments of human capital and of non-human non-material capital, respectively; and b and c coefficients that add to 1. Technological changes in capital inputs are measured by a .

Then MKOR carries its traditional meaning only if dK causes of growth are large compared to the total of other causes. Otherwise changes in output will occur with only modest changes in capital inputs; that is, the ratio of dK to dO will fall when dO rises, and vice versa: MKOR's will be inversely correlated to the rate of growth.

The presumption that other inputs than conventional capital are dominant, and that in consequence MKOR--output change correlations are negative, is confirmed with nearly total regularity by Leibenstein's empirical tests: by 129 out of 134 observations.²⁶

But even in the cases where there is high positive correlation between dK and dO , the direction of causation is in part reversed: a rise in production, whatever its causes, will result in a rise in conventional capital formation. Suppose that a country's real income rises. We can perhaps attribute this autonomous rise, to borrow Cairncross' hypothesis for the Victorian era, to a compound of technological change, growth of markets, and entrepreneurial zeal and effectiveness. Then a linkage effect will be at work: more warehousing is needed, more transportation including road, railway, and/or air equipment, more distribution facilities; and for some products more intermediate or final processing and adapting. Or suppose the government out of rising revenues spends more, as is likely, on building and equipment. In each case investment rises, but as a

²⁶For 17 countries, year-to-year changes related to each other. Harvey Leibenstein, "Incremental Capital-Output Ratios and Growth Rates in the Short Run", Review of Economics and Statistics (February, 1966), pp. 20-27.

result of the initial increased production.

There is also the effect on consumer's capital. If population is not growing as fast as production grows, average real income is rising. Among the things consumers will spend their larger incomes on is housing.²⁷ The housing portion of gross income is considerable: the 1953-61 average for 16 higher-income countries ranges from one-sixth to one-third.²⁸ In addition, acceleration effects from any rise in consumer spending proliferate through an economy and swell investment outlays--but as effects, not causes, of the initial production increase. In these cases, investment is needed during the growth process, but to avoid supply-demand distortions and make possible a continuation of growth, rather than to be the initiating force.

Empirical MKOR's therefore measure jointly: (1) the inverse of the rate of growth of production due to non-capital-input causes; (2) consumer income-elasticity of demand for housing; and (3) acceleration effects from other consumer spending--these in addition to what MKOR's are conventionally supposed to measure: (4) the effect of added capital toward increasing production.

B. There are several capital-output relationships that permit major increases in production without increases in the quantity or quality of capital, and perhaps even with a decrease. The reasoning below can apply to a given industry, without any technological change taking place.

1. Income can obviously rise from increased utilization of existing capital. In many a country, holidays are numerous: religious

²⁷Cairncross, op. cit., p. 100.

²⁸From data collected by T.P. Hill, op. cit., p. 290.

holidays compound with patriotic ones to cut the work year. Colombia's normal 220 days a year could be increased by 22 percent through adoption of a 5-1/2 day week with a modest 6 holidays a year and two-weeks vacation pattern. To have people willing to get along on fewer holidays turns on stronger incentives, possibly better health, and simple willingness to make a change.

Similarly, equipment and buildings can be used two or three shifts a day, with ~~some~~ time down for repairs and maintenance, rather than one shift only. Equipment can be run a near-24 hours a day. Buildings need not stand empty and idle most of the time: evenings, nights, mornings and weekends can be exploited. If labor and supplies are available, and there is willingness to adjust habits and organization then output can rise from this cause by a factor of 100 to a near 200 percent from the same capital stock.²⁹

Also, there can be fuller use of over-built capacity. Cairncross points out that railway building in North America and Europe absorbed during the late nineteenth century a smaller amount of total national investment, but railroads none-the-less increased rapidly their hauling of freight and passengers.³⁰ Over-building can in special areas permit a

²⁹ Lauchlin Currie, Accelerating Economic Growth (New York: McGraw-Hill, 1965), p. 54. He estimates that in Latin America generally, even where industrial equipment is fully utilized during working hours, the combination of frequent holidays plus normal one-shift operation means such equipment is in use no more than 20 percent of the year. That is, a near five times rise in industrial production is possible, given adequate supplies of complementary factors.

³⁰ A.K. Cairncross, "Reflections on the Growth of Capital and Income", Scottish Journal of Political Economy (June, 1959); reprinted as Chapter 6 of Factors in Economic Development (London: Allen and Unwin, 1962), p. 103.

highly variable increment to production, complementary resources being available.

Capital often stands idle for lack of demand and effective organization-- a cause that sometimes overlaps the three phenomena listed above. In many a poor country and sometimes in richer ones also, equipment and structures are under-utilized because of the throttling effects on domestic manufactures of a syndrom of over-valued exchange rates, protectionism causing price hikes for intermediate goods inputs, and high urban wage rates sustained by government edict, and union pressures. These can more than offset the stimulus to production from inflating domestic demand, protectionism on final products, and specific schemes attempting to expand imports. In India, for example, manufacturing production has in recent years been running much below its potential.³¹ In Indonesia, an extreme case, the utilization of equipment has recently been, by crude estimate, at 15 percent of capacity. The priority issue, when production is running sharply below capacity, is not more capital, but better utilization of what capital there is.

2. Another reason why national production can often be raised without changing the existing quantity of capital is implied in the rising share of government in economic decisions. Government direction of resource flows is, for right reasons and wrong, relied on much more than it was in the past; and this reliance has its implications. In the nineteenth century and before, merchandising, craft production, and

³¹"The Ministry of Commerce and Industry takes the view that the extent of under-utilization of industrial capacity is of the order of 15 to 20 percent", Report of the Import and Export Policy Committee, Ministry of Commerce and Industry, New Delhi, 1962, p. 10.

even factory-type production, were often started up in a corner of the house or in the barn; and so also were private schools and hospitals. But under the aegis of government, institutions must have a dignity suited to that of the State. The inefficiency may go deeper than this tendency: in many a country showpiece investment swallows up the government surplus: a new airport to take the newest jets, a new highway to the capital from the airport, air-conditioning for the Ministry of Finance, or perhaps even statues of the President.³²

On the average, less of prudent economic calculation is going into the government decisions of many countries, and probably of the typical less developed country, than have gone and go into the agonizing appraisals and reappraisals of businessmen hazarding their own money. If there is more of politically-explained wrong allocation of investment than existed in the past, then the importance of a simple increase in quantity of capital is lessened,³³ and problems of strategy in improving the economic efficiency of political decisions--reform mongering³⁴--gains higher priority.

³² Arthur Lewis comments on public investment in less developed countries: "Public factories, schools, hospitals, and other structures are nearly always colossal, striking, and expensive, built to the glory of their architects and their supporting politicians". Unemployment in Development Countries, Lecture at Mid-West Research Conference, Chicago, October, 1964, p. 16. "I would give high marks to a development programme in which only 10 percent of the expenditures was in nonsense of this kind". Economic Bulletin of the Economic Society of Ghana (May-June, 1959).

³³ Clair Wilcox, in his excellent study of the subject, concluded that economic development has not been the central concern of any government in Southeast Asia, The Planning and Execution of Economic Development in Southeast Asia, Occasional Paper 10, Center for International Affairs, Harvard University, 1965, p. 35. Despite their mixed purposes, these governments are more involved in economic policy decisions than ever before.

³⁴ As Albert Hirschman calls it: Journeys Toward Progress (New York: Twentieth Century Fund, 1963).

3. Sometimes income rises because of using a decreased amount of capital. In recent years rice cultivation in Ceylon used, following traditional procedure, excessive quantities of irrigation water. Soil nutrients were leached away. Less water and smaller irrigation works could have raised rice production.

Many a technical advance diminishes capital needs: the telegraph and wireless replace the pony express and railroad communication. The implied priority problem is what innovations, which may be capital-saving, can be efficiently adapted into a particular region, given its economic, social, and political conditions.

C. It has become commonplace to evaluate the human factor--health, energy, technical skills, habits of regularity and responsible helpfulness-- as a major determinant of economic advance. Health and energy require among other things adequate nutrition, sanitary habits and facilities, and medical care. Formal education, beyond a point, seems to be thought less important for productive efficiency than it was considered a few years ago, and training in practical skills near the point of use, and on-the-job training more important.³⁵ Also critical is the cultivation of responsibility, concern, and willing cooperation toward productive goals. The use of leisure time for self-improvement can be highly productive. Finally, one

³⁵In an experimental study in India, Harbarger's data suggest that marginal returns on education are somewhat lower than those on investment in physical capital. Arnold C. Harbarger, "Investment in Men versus Investment in Machines: The Case of India", in C. Arnold Anderson and M.J. Bowman, eds., Education and Economic Development (Chicago: Aldine, 1965), p. 29. Myint states firmly that: "The educational effect of apprenticeship and promotion to skilled grades in ordinary economic life is more far-reaching than huge sums of money spent on educational institutions". (H. Myint, "An Interpretation of Economic Backwardness", Oxford Economic Papers (June, 1954).)

of the simplest ways of raising productivity is to have people move from places and jobs where they are less productive to where they are more so.

Added real outlays are not always needed to achieve these improvements in human productivity. Where they are, some would be classified as conventional investment, others would usually be listed as consumption.

There is striking contrast between the trivial estimated loss to GNP found in a number of empirical studies from wrong allocation of resources (in seven different studies of 4 countries and 2 regions, between .01 and 1 percent), and the wide efficiency gains rewarding better motivation and organization (for example, as result of 27 ILO productivity missions, a median rise in work productivity of 41 percent).³⁶

Leibenstein considers the explanation to be that:

"...the relation between inputs and outputs is not a determinate one. ... (a) contracts for labor are incomplete, (b) the production function is not completely specified or known, and (c) not all inputs are marketed, or if marketed, are not available on equal terms to all buyers."³⁷

Most people and organizations are working well within their production capacities. The critical problem of raising production seems often that of diminishing the gap: of enabling and persuading them to work more productively.

The conventional savings-investment model checks consumption growth or cuts it, so that maximum savings flow into capital goods creation. But: (a) In most economies--even in those with highest incomes, and

³⁶ Harvey Leibenstein, "Allocative Efficiency versus 'X Efficiency'", American Economic Review (June, 1966), pp. 393, 400.

³⁷ Ibid., pp. 407, 412.

emphatically in the poorer ones--a large proportion of the population are living at levels of consumption of food, clothing, medical and sanitary services (plus housing, which happens to be classified as investment) that are closely correlated with their ability to produce. The peasant of China, India, and Guatemala is said to know for how many hours of digging on his land a handful of rice or corn will provide energy, or for how many miles it will enable him to carry a burden. As for health, little work can come from people suffering from malnutrition from lack of calories or protective foods, or are weakened by malaria, filaria, tuberculosis, intestinal parasites, or other diseases.

Barely to exist requires a considerable consumption intake. The marginal cost of raising consumption to enable six, or eight hours of work to be done, can offer a good bargain to a society.³⁸

(b) Furthermore, incentives are crucial. Among the most solid and least subject to erosion by cynicism are the incentives of obtaining more of the goods and services people want. To the extent this diagnosis holds in a given area, the most incentive-carrying consumer goods and services are what are needed. Wrist-watches, transistor radios, fountain pens, sarees, and bicycles can be more useful toward higher incomes than generators, drill presses, lathes, and locomotives. A conventional policy of raising taxes or raising consumer goods prices and making them more scarce, to the end of raising the saving rate and so the rate of accumulation

³⁸Looking to food only: suppose that to keep a person alive requires 1500 calories a day, and that to work takes an added 300 calories an hour. Then zero work requires 1500 calories (unless the person is let starve)-- 4 hours work costs 2700 calories, or 675 an hour; 8 hours work 3900 calories, or 488 an hour. Cf. Stephen Enke, Economics of Development (Englewood Cliffs: Prentice-Hall, 1963), pp. 366-67.

of capital goods, can have the perverse effect of actually cutting the rate of accumulation of capital goods, if a discouraged and enfeebled work force reduces its supply of effort sufficiently.³⁹

Some light on the practical question of priorities is found in the judgments of the 24 country Missions sent out by the International Bank for Reconstruction and Development, 1949 to 1961. The Missions generally gave highest priority to increased output of essential consumption goods, especially agricultural products; second priority to the tertiary sector, especially transportation; and third place to education. These priority goals are partly intermediate (the means to growth) and partly ultimate (the purpose and definition of growth); and they are achieved by real outlays that would be classed conventionally both as investment and consumption.⁴⁰

D. Economic advisers often come back from less developed areas impressed by the crucial influence on growth possibilities of institutional or organization changes. Some resource flows to improve institutions or organizations can be classed as traditional investment (non-human material capital formation), some cannot.

V

The implication of this paper is that the traditional model of economic growth, in which non-human material capital formation is taken as the

³⁹Arthur Smithies, "Rising Expectations and Economic Development", Economic Journal (June, 1961), p. 269. Smithies develops the case for economic growth set in motion by rising expectations for consumer supplies.

⁴⁰Dorra H. Alwan, An Analysis of Investment Criteria in Mission Reports of the International Bank, unpublished doctoral dissertation, Appendix II, B, "Priorities", University of Wisconsin.

central issue with qualification entered for other influences, is much less than ideal. It is awkward in theory, and has probably been on occasion perversely misleading in practice. Its deficiencies are peculiarly great with respect to the growth problems of less developed areas.

A more coherent and general model of growth is needed. The logic of policy for economic growth is, irrespective of conventional or national income divisions between consumption and investment, to set up a hierarchy of uses for resource units, from those whose social returns are highest to those that are lowest. The hierarchy is determined by as detailed cost-benefit analyses as are feasible. The total resources to be made available for development--which determines the cut-off point in the hierarchy, between projects that will and will not be undertaken--are a variable, whose quantity is in part determined by the marginal development promise of those resources. For any given place and time it is unlikely that a perfectly wise policy board will find a gap in the hierarchy, with "investment" above and "consumption" below. Those outlays will probably be intermingled along the scale; some conventional "consumption" uses of resources may be at or near the very peak.

To apply the term "investment" to a higher range of the scale, or to all resource uses that raise future potential consumption, has the advantage of avoiding a change of language. But it will mislead every hearer who has not forcibly dug his way out from the traditional meaning. It seems more accurate in analyses of growth problems, and in practice less likely to mislead, simply to speak of the hierarchy of resource uses, and within that hierarchy, to evaluate items without prejudice or favor because of their belonging to a conventional "consumption" or "investment" classification.