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EDUCATION AS A SOURCE OF ECONOMIC GROWTH

prepared by

Theodore W. Schultz

It is altogether proper that we should prize highly the cultural contributions of education but it is very short sighted of us not to see its economic contributions. Education has become a major source of economic growth in winning the abundance that is to be had by developing a modern agriculture and industry. It simply is not possible to have this abundance as long as the people are predominantly illiterate and unskilled. Education, therefore, in addition to having high cultural values, is presently also an investment in people for it improves human capabilities and thereby increases the future earnings of people.

The burden of this paper is to set forth the nature of the analysis and some of the preliminary results from such an analysis bearing on the proposition that education has become a major source of economic growth. I trust it will help the reader to have me outline the main subjects to be discussed in this paper. They are as follows:

1. Measured economic growth and measured sources;
2. Omitted, unmeasured sources;
3. Beliefs and values that enter;
4. Education as an industry;
5. Investment opportunities among resources;
6. Education as a class of investment activities;
7. Effects of education upon consumption and earnings;
8. Resources entering into education;
9. Return to education;
10. Education as a measured source of economic growth;
11. Some reflections about the relevance of this treatment of education to Latin America.

1. Measured Economic Growth and Measured Sources

By "economic growth" we shall mean increases in real income. Thus, for a country, it refers to increases in national income or in
/national product

national product expressed in constant dollars, pesos, cruzeiros or whatever the unit of money. "Measured economic growth" refers to increases in real income as income is presently being measured representing the output of marketable goods and services. Measured economic growth, however, takes no account, for example, of increases in free time as hours of work per week decline or of improvements in taste that come as a consequence of education.

For a moment, look upon economic growth as a game, the object of which is to acquire the sources of additional income. These sources of economic growth are not free; each source has its price tag and some sources are dear and some are cheap. So in playing this game it is important to acquire those sources that are relatively cheap for this is the key play to winning in this game. The first difficulty is to find the sources, and the second is to determine what the price tags mean.

It is true that the sources of economic growth were long considered settled in the core of economics. They were land, labor and capital. Since the amount of land is as a rule a constant, more labor and capital are the sources that account for economic growth. Furthermore, since the increases in the size of the labor force are predominantly a consequence of the growth in population, we are left with capital, the formation of which is really subject to economic decisions. Capital in this connexion has meant, leaving pure land aside, tangible goods - structures, equipment and inventories that are reproducible. Thus, the planned (economically decided) increases in capital goods and the increases in the labour force that occur naturally were the received sources of economic growth. There are economic models plenty based on these sources. The game of growth using such models is to keep capital and labour in step one with another while increasing their pace.

But economists who are quantitatively minded are rudely interrupting this old simple game of economic growth by showing that increases in capital goods and in the labour force do not account for most of the
/increases in

increases in measured national income. A few figures for the United States will show this. These estimates are from research sponsored mainly by the National Bureau of Economic Research, and prominent among those who have done this pioneering work have been Kuznets, Goldsmith, Abramovitz, Kendrick and Fabricant. Fabricant's Basic Facts on Productivity Change is a useful summary of these estimates. What emerges is that between 1919 and 1957, by adding only 1 per cent in total inputs of tangible capital and manhours per annum, the United States economy "in its generosity" has been increasing real income by about 3 per cent per year! These estimates are presented in Table 1 not only for 1919 to 1957, but, also, for the period 1889 to 1919.

Some divergency between measured inputs and measured economic growth also appears to be occurring in Latin America, although the difference between them is much less than in the United States. The best data available to me are from the research of the Economic Commission for Latin America. Using these and including land as one of the inputs because it is clear that some new land has been made accessible and drawn into production in parts of Latin America, my estimates for Latin America, for the period between 1945 and 1955, show an increase in measured economic growth of 61 per cent (4.88 per cent per annum) compared to an increase in measured inputs of 36 per cent (3.12 per cent per annum). Thus, even allowing for considerable lack in comparability in data, there is an inference that measured economic growth in Latin America, although in excess of measured increases in inputs, has not been increasing at a rate that is three times as large as that of measured inputs.

A few years ago when I first realized how weak the connexion was in United States agriculture between increases in output and inputs, I examined some estimates for countries of Latin America that had become available from the research of Ballesteros, Moore and subsequently from Wharton at the time they were graduate students at the University of Chicago. These estimates show that increases in measured inputs

Table 1

UNITED STATES: INCREASES IN OUTPUT AND INPUTS OF THE PRIVATE
 DOMESTIC SECTOR OF THE ECONOMY, 1889-1957

	Average annual percentage rates of increase			
	1889	1919	1919	1957
1. Total output		3.9		3.1
2. Labor (weighted manhours)	2.2		0.8	
3. Capital (weighted tangible capital)	3.4		1.8	
4. Total inputs		2.6		1.0
5. Divergency: percentage line 4 is of line 1		67.0		32.0

Source: Solomon Fabricant, Basic Facts on Productivity (Occasional
 Paper No 63 New York: National Bureau of Economic Research,
 1959), table 5.

/were larger

were larger (leave Argentina of the Peron period aside) relative to the increases in measured output than in the United States. Accordingly, although increases in agricultural output have been exceeding increases in agricultural inputs in Latin America, the differences between them have been less than in the United States.

2. Omitted, Unmeasured Sources of Economic Growth

There is no way of stretching the additions in capital goods, i.e., in structures, equipment and inventories, and the increases in employed manhours to explain measured economic growth in the United States. If new land and improvements in land are added, it still is true that most measured economic growth is not explained. What additional sources are there?

For the United States, there are three strong candidates. The rise in the education of members of the labour force is one of these. Another is represented by advance in knowledge that is useful in economic endeavour but that is not an integral part of the capabilities of the labour force. A third consists of gains from the economies of scale. Economists are beginning to put down actual numbers for each of these sources for the United States, but to the best of my knowledge, no one has attempted to identify and measure the contributions of these particular sources to the economic growth of countries in Latin America.

There are also several other sources of growth, although as far as one can tell they are presently weak candidates among the sources of economic growth in the United States. Some of them, however, are likely to play a strong role in Latin America if not already, then, in the near future. Adjustments in resource allocation among occupations, industries and regions which are required as a consequence of economic growth, can also be a source of economic growth. Mobility of labour and capital is involved and the rate and effectiveness of this mobility can improve or deteriorate over time. To the extent that

Table 2

INCREASES IN AGRICULTURAL OUTPUT AND INPUTS
 IN SELECTED COUNTRIES OF LATIN AMERICA
 AND IN THE UNITED STATES

Country and period	Percent change per decade	
	Inputs	Output
Argentina		
1920-1940	6	27.5
1940-1952	-6	-10
Brazil		
1925-1929 to 1945-1949	15	27
1944-1955	23	37
Mexico		
1925-1929 to 1945-1949	13.5	30
United States		
1930-1940	-5	16
1940-1958	1.7	29

Sources: See tables 1 and 2, Theodore W. Schultz, "Reflections on Agricultural Production, Output and Supply", Journal of Farm Economics, 38, Aug, 1956; Clifton R. Wharton, Jr., "The Economic Impact of Technical Assistance; A Brazilian Case Study", Journal of Farm Economics, 42, May 1960, table 2; and Zvi Griliches, "Measuring Inputs in Agriculture: A critical Survey", Journal of Farm Economics, December 1960, Proceedings Issue, table 5.

/these adjustments

these adjustments are improved, they become a source of economic growth. Still another source is represented by changes in the lag with which new and better knowledge is adopted. While there has been some gain from this source in the United States, notably in agriculture during recent decades, altogether this lag is now short and not likely to be a major source of additional economic growth. But throughout most of Latin America, this lag in the application of knowledge, given the stock of such knowledge and additions to it available to these countries, is very considerable. The reduction of this lag can become one of the major sources of economic growth in Latin America, as is already the case in a few rapidly advancing centres of growth within particular countries. (There are also the effects of fewer hours of work (per week). When the normal work week is long a small reduction in hours is likely to be virtually offset by a rise in output per manhour, whereas when the work week is short a small additional reduction in hours is offset only in small part or none at all by a rise in output per manhour).

What I have stressed so far is that economic growth escapes our grasp when we try to take it with only two fingers. Capital goods and the labour force will not do it. These two and economies of scale, advance in knowledge and in education give us, however, a strong hand. My principal task is to examine education. How much does education contribute to economic growth? What is the return of education? In answering these questions, I propose to treat schools (organized education) as an industry that produces instruction and that this instruction represents an investment in people.

There is, however, a preliminary issue that needs to be considered.

3. Belief and Values that Enter

I am ever apprehensive that some people who are concerned with education may reject this treatment of the economic value of education out of hand^{1/}. They may do so because they are strongly of the belief that the cultural attributes of education are beyond economies and that

^{1/} In each of my papers on the economics of education I have tried to anticipate this "moral" issue for it always arises in discussions with educators and other thoughtful persons concerned with education. I trust I am not be-laboring this matter.

the human values which education seeks to transmit to students will be debased if economic values were to be applied and because they look upon "investment" and "industry" as relevant only to the market place where material things are made and sold and, therefore, not to the classroom where human beings are taught. In the main, the difficulty here arises because there has not been an adequate realization that education can and does improve particular capabilities of students which are useful in economic endeavour; that studies to identify and measure this contribution of education, do not presume that there are no other, and for that matter, more important cultural contributions (what is implied is that among its contributions some kinds of education improve the capabilities of a people on which they draw as they work and manage their affairs and that these improvements are a source of economic growth); and that economic analysis is not confined to material things.

No doubt one of the main reasons why economists have shied away from an explicit analysis of investment in human capital can be traced to their reluctance to enter upon these "moral and value" issues. I had occasion to comment on this matter with care in my "Investment in Human Capital" and rather than attempt to restate, let me quote from that paper:

Economists have long known that people are an important part of the wealth of nations. Measured by what labour contributes to output, the productive capacity of human beings is now vastly larger than all other forms of wealth taken together. What economists have not stressed is the simple truth that people invest in themselves and that these investments are very large. Although economists are seldom timid in entering on abstract analysis and are often proud of being impractical, they have not been bold in coming to grips with this form of investment. Whenever they come even close, they proceed gingerly as if they were stepping into deep water. No doubt there are reasons for being wary. Deep-seated moral and philosophical issues are ever present. Free men are first and foremost the end to be served by economic endeavour; they are not property or marketable assets. And not least, it has been all too convenient in marginal productivity analysis to treat labour as if it were a unique bundle of innate abilities that are wholly free of capital.

/The mere

The mere thought of investment in human beings is offensive to some among us. Our values and beliefs inhibit us from looking upon human beings as capital goods, except in slavery, and this we abhor. We are not unaffected by the long struggle to rid society of indenture service and to evolve political and legal institutions to keep men free from bondage. These are achievements that we prize highly. Hence, to treat human beings as wealth that can be augmented by investment runs counter to deeply held values. It seems to reduce man once again to a mere material component, to something akin to property. And for man to look upon himself as a capital good, even if it did not impair his freedom, may seem to debase him. No less a person than J. S. Mill at one time insisted that the people of a country should not be looked upon as wealth because wealth existed only for the sake of people. But surely Mill was wrong; there is nothing in the concept of human wealth contrary to his idea that it exists only for the advantage of people. By investing in themselves, people can enlarge the range of choice available to them. It is one way free men can enhance their welfare.^{2/}

4. Education as an Industry

Education has become an activity in which schools specialize. Schools may be viewed as firms that specialize in producing educational services. The services they produce may satisfy particular cultural preferences of people or they may improve the economic capabilities of people. To produce these educational services entails real costs because it takes resources - teachers, school administrators, books, libraries, and laboratories. In a broader classification, schools are one class of specialized firms that produce and distribute knowledge. Institutions that specialize in research (without offering instruction) also produce knowledge. If we were to follow Machlup in his conception of "producing knowledge" one would, also, include the firms that make up the various media of communication, and those that produce the apparatus, equipment, and machinery for communication and the information services.^{3/}

^{2/} Theodore W. Schultz, "Investment in Human Capital", American Economic Review, 51, March 1961.

^{3/} Professor Fritz Machlup is publishing a major study on Production of Knowledge. It has been my privilege to read his manuscript.

There is much to be said for investigating the performance of education treating it as an industry. What we would want to know is the type and quantity of inputs that are employed, the combinations of inputs that are used, the "quantity" of output that is realized, and thus the "efficiency" with which the transformations are made. The inputs entail costs and the output is a return. Here, too, some readers will protest because of their belief that these resource costs of education and returns to education are thought to be only remotely relevant to the essence of education. The resource costs are facts, nevertheless, that cannot be denied whatever the purposes of education; moreover, they have become very large in some countries as I shall soon show. The returns may be predominantly cultural but however important the cultural component may be, these returns have also become impressively large, particularly in the United States, and presumably in other countries as well.

Organized education (schools) requires a specialized set of resources and, as already noted, they consist of teachers, school administrators, classrooms, libraries and laboratories. The quantity of these resources entering into education in the United States and other technically advanced countries makes it a vast industry. Eddings's^{4/} study shows that public school expenditures in 12 of his 23 countries were equal to 3 per cent or more of the countries' national income in 1954. Edding did not have available to him estimates of private school expenditures and, very important, estimates of earnings foregone by mature students while attending school. Even so his estimates are instructive in the fact that the technically advanced countries rank high by this test, including notably Japan and the Soviet Union. None of the five Latin American countries included in this study had reached this 3 per cent mark.^{5/}

4/ Friederich Edding, International Tendenzen in der Entwicklung der Ausgaben für Schulen und Hochschulen. Kieler Studien. Kile, 1958. Table 2 and statistical appendix pp. 143-44.

5/ For 1954 public school expenditures as a percentage of national income were 2.3 per cent in Brazil, 2.1 in Chile, 1.7 in Colombia, 1.5 in Ecuador, and 1.1 in Honduras. For Japan the comparable figure was 6.1 per cent. See Edding, already cited, p. 144. These expenditures do not include private school expenditures, nor do they include any estimates of earnings foregone by students.

Elementary, secondary and higher education in the United States has become an industry that now exceeds \$30 billions in total resource costs. It had already reached \$28.7 billions in 1956 distributed as follows:^{6/}

	<u>Billion dollars</u>	<u>Per cent</u>
Public school resource costs	13.1	46
Private school resource costs	3.2	11
Earnings foregone by students	<u>12.4</u>	<u>43</u>
Total resource costs	<u>28.7</u>	<u>100</u>

In 1956, measured by the resources then entering into education, they were equal to 10.3 per cent of total measured consumer income in the United States. Another measure is in terms of labor inputs. The number of teachers was 2.3 per cent of the employed labor force and the number of teachers plus students in high school and in higher education who could have entered the labor force, were equal to 18.8 per cent of the employed labor force.^{7/}

5. Investment Opportunities Among Resources

Before examining education as a particular form of investment, let us examine investment opportunities generally. An investment is a commitment of present income to increase future income. When an investment is made to improve the capabilities of people, the expectation is that it will increase their future earnings. We are, however, so accustomed

^{6/} Theodore W. Schultz, "Capital Formation by Education", Journal of Political Economy, 68, December 1960, based on Tables 3 through 6. "Additional expenditures" appearing in col. 5 of Tables 5 and 6 were distributed according to school costs.

^{7/} Theodore W. Schultz, "Education and Economic Growth", Social Forces Influencing American Education, 1961, Nelson B. Henry, ed., (Chicago: The National Society for the Study of Education).

to think only of investment in capital goods - structures, equipment and inventories - with a view of increasing future income from these sources, that it is exceedingly difficult for us to see ourselves as the object of investment. We come up against an array of mental blocks some of which have already been mentioned under "beliefs and values". A lay view might be that investment pertains only to resources that can be bought and sold and since human capabilities are not a marketable asset, there can be no investment in people. But the test of an investment is in its effects on future income or earnings and not in whether a person can transfer and sell the stock of capabilities he has acquired. There is indeed a "market" in terms of wages and salaries for the services he can render, say, as an engineer.

To break through these mental blocks that imprison our minds, we must think of human resources as well as of other resources as produced means of production. We can in fact add to the stock of any of our measured resources by appropriate investments. I am, of course, mindful that economists may find it useful for some purposes to define particular resources in such a way that they are in their "natural" state, free of any capital added. Land, viewed as the original properties of natural resources, is often defined in this way. No doubt labour can be treated in the same way, by letting labour represent the "original" biological capacity of workers with a view of abstracting from "all" capital in human beings. This treatment of resource is in essence the classical tripartite conception of the factors of production - land, labour and capital. One of the implications of this conception is that neither land nor labour are "formed" by investment. I have pointed out elsewhere^{8/} that the long neglect by economists of investment in man can be traced back to the persistence of the classical conception of labour and to the strong influence of Marshall who argued for a definition of capital that

8/ Theodore W. Schultz, "Investment in Man: An Economist's View", The Social Service Review, 33, June 1959; also "Investment in Human Capital", cited earlier.

would keep economics in touch with the market-place and who dismissed Fisher as being unrealistic in his comprehensive concept of capital which included man.

Let us, however, take the comprehensive view of capital and treat labour as a resource that is predominantly a produced means of production. Human resources obviously have both quantitative and qualitative dimensions. The number of people, the proportion that enter upon useful work, and hours worked can be treated as quantitative characteristics. Education clearly is a qualitative component of human resources. Let me assume that there are many opportunities to invest in man and that such investments explain in large measure the rise in the share of the national income that people earn.

A highly simplified conception would be that investment opportunities are basically proportional to the existing quantity of resources; based on the assumption that the marginal returns to investment in each class of resources are equal and that additional proportional investments to increase the stock of each of these resources is subject to the same rate of diminishing return. In the United States, at factor costs, natural resources contribute about 5 per cent, reproducible capital goods about 20 per cent, and labour about 75 per cent of the national income. By this test, then, the opportunity to invest in human resources is three times as large as it is to invest in natural resources and capital goods combined.

We know, however, from the experience of recent decades that these resources have not been maintained in constant proportions over time. Natural resources have declined and human resources have increased over time relative to all resources employed. In the United States, between 1929 and the present, natural resources (land) at factor costs in national income have declined steadily from 9 to about 5 per cent, whereas human resources (labour) have risen from 69 to about 75 per cent.^{9/}

^{9/} This estimate for human resources will vary somewhat depending on whether it is restricted to the private economy (used by Kendrick and by Fabricant, see table 1) which gives the 75 per cent estimate of all labour in the economy (Denison) which gives a somewhat larger estimate, 77 per cent for 1954-1958.

The opportunity to increase the stock of natural resources by investment is relatively small. As already noted, economists as a rule find it convenient to treat natural resources (land) as a constant and on this assumption the investment opportunity would be zero. But much of what we treat as land is in fact in substantial part reproducible capital and to this extent we do increase the stock of measured land. Now and then someone will find a pool of oil, a ten foot vein of coal, or a rich ore deposit and thus acquire additional future income cheaply. But natural resources are not among the more promising sources of future income because they have become so small a contributor to national income and because farm land bulks large and good farm land is no longer around for the taking. Of course, there is some land that can be cleared, drained or irrigated, but surely the Dutch are paying a high price for the little economic growth they are getting from driving back the Zuider Zee and the Italians from developing a little farm land taking it from the Adriatic Sea at the mouth of the Po. More irrigation in India or in California, even though the government foots the bill, is not a cheap source of additional income. There is, of course, some good land to be had for farming in parts of Latin America and elsewhere too that is presently inaccessible for lack of roads which will earn a high return to the investment required to make it accessible.^{10/}

Reproducible capital goods, as these are commonly defined, also, have declined somewhat over time relative to all resources in the United States. Thus under our simplified assumption investment opportunities in capital goods have been shrinking a bit relatively. In the main, investments in plants, equipment and inventories are closely priced, although laboratories and experiment stations are priced very imperfectly. The latter produce now and then a very

^{10/} Here I draw on my "A Critique of U. S. Endeavours to Assist Low Income Countries Improve the Economic Capabilities of Their People". Read before the American Farm Economic Association, August 15, 1961. To be published in the Journal of Farm Economics.

valuable product but new knowledge conforms at best slowly and imperfectly to the costs and returns rules of other capital goods. Basic research is a venture characterized by many failures and few successes. It is impossible to hold on to new knowledge with a view of selling it for all that it is worth. But some of the successes are exceedingly rewarding in what they ultimately contribute to national income. Hybrid corn has become a classic which, as Griliches has shown, was producing, as of 1955, \$ 7 of national income for each \$ 1 that had been spent on producing it: \$ 902 million of additional income that year from the \$ 131 millions of accumulated past research expenditures.^{11/} Thus, in developing hybrid corn, instead of paying \$ 25 or even as little as \$ 10 for a \$ 1 income stream, we had acquired each \$ 1 of income coming from this source for only 15 cents!

When all is said and done, the principal resource is labour; it is three times as large as all the other resources together. Moreover, human resources have increased relatively over time although employment has been of slow growth, about 1.3 per cent per annum in the United States between 1929 and 1957. But even this slow rate of increase does not take into account the decline in the annual hours worked which fell close to one-fifth, or about .7 of one per cent, per annum between 1929 and 1957. It is the capability of the labour force that has been improved and these improvements have resulted from a major investment outlay. Education clearly has been exceedingly important among the investments to improve economic capabilities of members of the labour force. A comparison of the increase in the stock of reproducible capital goods and of education in the labour force strongly supports this inference. Between 1930 and 1957 the stock of capital goods rose from \$ 735 to \$ 1,270 billions, an increase of about 70 per cent, whereas the stock of education in the labour force, 14 years and older, rose from \$ 180 to \$ 535 billions, a rise of 200 per cent.^{12/}

^{11/} Zvi Griliches, "Research Costs and Social Returns: Hybrid Corn and Related Innovations", Journal of Political Economy, 67, October 1955.

^{12/} See Table 14, p. 73 of "Education and Economic Growth", cited earlier.

6. Education as a Class of Investment Activities

The purpose of this very brief section is to do no more than list the principal activities that are connected with what we are calling "investment in human capital". Let me repeat, that the purpose of an investment is to increase future income, and by this test, the purpose of an investment in people is to increase their future income either in terms of the satisfactions they obtain (as consumers) or in terms of earnings they realize (as producers). The distinction between these two classes of investment in man will be clarified in section 7 below.

Formal schooling - elementary, secondary and higher education - is only one of several investment activities that increase future income. It, however, appears to be the most important of these activities at this stage in high income countries and in countries achieving a high rate of economic growth. The principal activities are 1) formally organized education at the elementary, secondary and higher levels; 2) on-the-job training including old-style apprenticeship organized by firms; 3) study programmes for adults including extension programmes in agriculture; 4) health facilities and services that affect life expectancy, strength and stamina and the vigour and vitality of a people; 5) migration of individuals and families to adjust to changing job opportunities (it belongs here as is clear when migration is analyzed to determine what it costs and what the returns are); 6) learning about the economic system; and 7) several institutions that are not included in 1), 2) and 3) above, for example, training and instruction in the home and in the armed services.^{13/}

7. Effects of Education upon Consumption and Earnings

The consumption component of education is either for current consumption; satisfying consumer well being in the present, like food or for future consumption, like houses. Not all education, however, is for consumption although all education is so classified in the way we do our national income accounting. Education, as we

^{13/} This classification is slightly more extensive than the one presented on page 9 of my "Investment in Human Capital", already cited.

have already noted, also improves the economic capabilities of people and thus enhances their future earnings. The investment formed by education is, therefore, of two parts: a future consumption component and a future earnings component.

In "Education and Economic Growth"^{14/} in examining education for consumption, I emphasized the current consumption component. It is now clear to me that most of education that satisfies consumer preferences is for future consumption and that this component has substantial durability and it is, therefore, to the extent that it serves consumption, mainly an enduring consumer component, even more so than other consumer durables. As an enduring consumer component, it is a source of future utilities (and thus this component, also, contributes to future real income) which in no way enters into measured national income. This component is accordingly like investments in houses, automobiles, refrigerators, and the like. Thus, we have the following: 1) education for current consumption (which, so it seems to me, is of minor importance); 2) education for long period future consumption making it an investment in an enduring consumer component, which is undoubtedly of considerable importance; and 3) education for skills and knowledge useful in economic endeavour and, thus, an investment in the future earnings.

8. Resources Entering into Education

If education were free, people would consume it until they were satiated and they would invest in themselves until the return to education were zero. But education, as everyone knows, is far from free although a part of it may be at public expense, and to this extent, private costs will be less than the total costs of education. Education is in fact expensive, much more expensive than most students of education have realized. Because it is costly, and because it is commonly treated as "consumption", the mistake made by many observers is to look upon all advances in education as a luxury that people
^{14/} See "Education and Economic Growth", cited earlier.

/can afford

can afford only after they are relatively rich. But to the extent that education increases future earnings, people with low income may not only profit but the rate of return to that part of education which is of the nature of an investment may be high, as high as or higher than the return to alternative (conventional) investments.

In analyzing the allocation of resources to education it will be necessary to consider both the costs of education and the return to education. It will be useful in a number of situations to distinguish between the allocative decisions made by students and by the community.

The costs of education to the individual are less as a rule than they are to the community (economy). If all costs were borne by the community (government), the individual would find it to his advantage to "invest" in additional education until it would no longer increase his future earnings (to the zero return point). Thus, to the extent that costs to the individual are less than to the community, the return to education will be higher to the individual than to the community. It would be premature, however, to deduce from this relationship that individuals generally over-invest in education for the simple reason that the individual is as a rule not well informed about the effects of education upon his future earnings, that the community (government) rarely bears all of the costs of education (notably, earnings foregone by the student while attending school are usually borne by the student or his family) and that the capital market is very imperfect in making funds available to students so that they can invest in themselves, e.g., to cover earnings foregone while attending school on the assumption all other costs of education were at public expense.

Thus, it should be clear that it is important to distinguish between individual and community costs of education. The estimates of costs which follow are, however, restricted to the costs of education to the economy (country) as a whole. In drawing inferences from

/then it

them, it should be borne in mind that individual costs in particular circumstances may be less. It follows, also, that whenever the return to education is relatively high for the economy, the return to individuals will be still higher to the extent that individuals do not bear all of the costs of education and yet obtain all of the increases in earnings from their education.

Ideally we want a measure of the annual flow of inputs employed for education consisting of the services of teachers, librarians, and school administrators, and the annual factor costs of maintaining and operating the school facilities and of depreciation and interest. All of these inputs are straightforward, although depreciation and interest are seldom treated properly because of inadequate data or because annual capital outlays are taken as the appropriate costs of school facilities, which they are not. Much more serious, however, is the omission of the opportunity costs represented by the earnings foregone by mature students, which represents a real cost both to the individual and to the economy. Moreover, this class of costs are as large as all the other costs of education together in the education of mature students who for this reason have earning capacities as workers were they to enter upon employment instead of attending school.

Earnings foregone. It will not be possible in this brief paper to set forth fully the economic reasoning which establishes the relevance of earnings foregone by students as a cost component in education or to outline a procedure for estimating them. Both of these subjects are presented in some detail in my "Capital Formation by Education".^{15/} Let me, however, call attention to a more recent set of estimates other than mine of earnings foregone by students in the United States made by R.C. Blitz^{16/} which are substantially higher than mine. Blitz has examined some of the items which I listed and treated as items that appeared to offset on another. Since he has examined only

^{15/} Pages 573 to 577 of "Capital Formation by Education", cited earlier.

^{16/} Rudolph C. Blitz, "The Nation's Educational Outlay for the Academic Year 1955-1956", to appear in a forthcoming volume on the Economics of Higher Education edited by Selma Mashkin, U.S. Department of Health, Education and Welfare.

those that would appear to increase my estimates of earnings foregone and none of those that would decrease them, notably the earnings of some student while they attend school, I am not convinced that his higher estimates of earnings foregone are as correct as are mine.

When one takes all of the costs of elementary, secondary and higher education, including earnings foregone by mature students in the United States, earnings foregone were 43 per cent of total costs in 1956. They rose, between 1930 and 1956, from 33 to 43 per cent of total costs. A better grasp of the importance of earnings foregone than the one just given can be obtained by examining them for the different levels of education. For elementary education, presently in the United States, it is hard to believe that earnings foregone enter as a cost although back no further than 1900 many children in the elementary grades were of considerable economic value as workers and some parents were keeping them out of school for that reason. Earnings foregone are a cost in elementary education when parents expect their older children (say, ages 11 to 14) to enter upon productive work, as do parents generally in low income countries. These expectations of parents are not to be dismissed lightly because the present earnings of their children are assured, whereas the prospects of larger future earnings by them from the added education are clouded with uncertainty, and because, in any event, these future earnings from this elementary education are not likely to come to the parents but to the children when they become adults.

For students attending secondary schools, earnings foregone are the largest component of total educational costs. In the United States, it has, however, been declining over time relative to other costs. According to my estimates, earnings foregone by students attending high school represented about 73 per cent of total costs in 1900 compared to 60 per cent in 1956. For college and university education in the United States earnings foregone were about half of all costs in 1900 and 1910 and by 1956 they had become virtually 60 per cent of total educational cost.

Estimates of earnings foregone for Mexico and Chile. Preliminary estimates by Carnoy and Yver indicate that earnings foregone by students

/while attending

while attending secondary schools and schools for higher education are larger than all other educational costs at each of these levels. For Mexico, Carnoy^{17/} has the following tentative educational costs:

	Total costs (in millions of pesos in current prices)	Earnings foregone	Per cent earnings fore- gone are of total costs
	(1)	(2)	(3)
A. Secondary education			
1935	30.8	18	58
1950	346	217	63
1957	1,236	757	61
B. University and Polytechnic education			
1950	121	76.5	63
1957	387	222.0	59

^{17/} Martin Carnoy, a graduate student at the University of Chicago, has been assisting me in studying costs and return to education in Mexico. His preliminary estimates are fairly far along. Earnings foregone are calculated for students age 12 and older. They are equal to 19 and 22 weeks of wages of workers in manufacturing in 1950 in Mexico for secondary and higher education, respectively, compared to 11 and 25 weeks in the United States in 1949 (my "Capital Formation by Education", Table 1, cited earlier). Carnoy is of the belief that his treatment of earnings foregone by students in universities and polytechnic schools gives estimates that are somewhat on the low side in view of apparent limitation in the data available to him.

/For Chile,

For Chile, for public education, Yver^{18/} has the following very tentative estimates of educational costs:

	Total costs (in thousands of escudos in 1960 prices)	Earnings foregone	Per cent earnings fore- gone are of total costs
	(1)	(2)	(3)
A. Public secondary education			
1920	4,506	2,908	65
1940	10,423	7,002	67
1959	38,964	28,957	74
B. Public college education			
1920	3,254	2,048	63
1940	5,662	2,931	52
1959	22,737	10,472	46

9. Return to Education

In section 7, we presented a logical basis for distinguishing among the three valuable components that education produces and that students acquire based on the proposition that education contributes 1) to current consumption, 2) to future consumption, and 3) to future earnings. The second and third of these components are both investments; one in an enduring consumer capacity and the other an investment in a durable producer capacity. Both of these investments are sources of real economic growth, but, as noted earlier, the increases in the satisfactions that people obtain from additions in this consumer capacity are not included in measured economic growth. Therefore, the return from only one of these investments in people by education is taken into account in the way economic growth is presently measured.

Increases in future earnings are quite tangible although it is far from easy to connect particular future earnings with particular past

^{18/} Raul E. Yver, also a graduate student at the University of Chicago, has been developing estimates for me of the resource costs of elementary, secondary and higher education in Chile. His work is in an early stage and, therefore, his estimates are subject to substantial revision as his study progresses.

education. Increases in future consumer satisfactions from education are less tangible which does not imply, however, that they are less real. Since costs are an important factor in determining the value of an investment, how are the costs of education to be distributed among the three components referred to in the preceding paragraph? This question deserves careful investigation because so much depends upon how educational costs are allocated when we come to estimating the return to education. It has been conventional to treat all such costs as entering into current consumption. There is, however, a growing awareness among economists that some education is an investment and a few economists are investigating this investment and its economic implications. So far, those who have entered upon such studies have, to the best of my knowledge, allocated all educational costs to investment in future earnings. Surely this procedure is as extreme and as unwarranted as the conventional practice of treating all educational costs as if they were current consumption.

But let me hasten to point out that whereas the economic logic for allocating the costs of education three ways is clear, there is presently no satisfactory empirical basis for identifying and measuring the particular resources that are employed to produce each of these three components. Faced with this difficulty, any allocation that one makes, based on such clues as seem relevant, is quite arbitrary. To allocate all educational costs to investment in human capabilities that increase future earnings, overstates the relevant costs entering into this investment and, therefore, necessarily results in an underestimation of the rate of return to that part of education that is undertaken to increase future earnings. I shall, nevertheless, present a set of rates of return based on such an allocation. But I shall also present another set of estimates of return to education that comes closer to existing circumstances. I find it plausible to believe in assessing what may be happening presently in the United States that approximately one-half of the total costs of high school education and three-fifths of the total costs of higher education represent investments in future earnings. I could elaborate on the reasons why I am drawn to these allocations but it would take me too far afield. My purpose here

is to place the reader on guard as to what I have done. The reader can with only a small effort recalculate my rates of return using whatever allocation of total educational costs he believes comes closest to the real facts as he sees them.

Miller's estimates of lifetime earnings and my estimates of educational costs including earnings foregone for three levels of schooling appear in Table 3.^{19/}

What, then, is the implicit internal rate of return for A, B and C shown in Table 3? Basically the analysis depends upon costs, average return per period and the number of periods. The number of periods in each case is sufficiently large to permit us to treat these periods as indefinitely large for purposes of discounting and by this procedure to obtain a satisfactory approximation. On the assumption that the internal rate of return on the cost of education minus depreciation is the same for each period, the relationships take the following form, with \bar{r} the average internal rate of return; L, the lifetime earnings; np, the number of periods, and C the costs of the education,

$$\bar{r} = \frac{L - C}{np}$$

The number of periods (years entering into lifetime earnings) is 50, 47 and 43, for A, B, and C, respectively. Thus, the internal rates of return for 1958 using the estimates of total educational costs and lifetime earnings appearing in Table 3 become 78 per cent for fifth, sixth, seventh and eighth years of elementary school, 23 per cent for both four years of high school and four or more years of college or university education. These internal rates of return are only for males. Nor are they adjusted for ability, race, occupations and regions. By linking the return to college or university education to Becker's estimates as I did in "Education and Economic Growth",^{20/} I reduced each about one half by taking

^{19/} See reference to Herman P. Miller in "Source" of Table 17, p. 79 of my "Education and Economic Growth", already cited.

^{20/} See pp. 77 and 78 of this essay for a complete reference to Gary S. Becker's forthcoming study and his one published paper on college education and his permission to draw upon his studies.

Table 3

ADDITIONAL LIFETIME EARNINGS OF MALES FROM AGES
 18 TO 64, BY LEVEL OF EDUCATION, COSTS OF
 EDUCATION, AND RATE OF RETURN FOR
 1939 AND 1958 IN THE UNITED STATES

	1939	1958
A. Fifth, sixth, seventh and eighth year of elementary school		
1) Additional lifetime earnings over that of individuals with 4 years of school	\$12 000	\$47 000
2) Costs of fifth, sixth, seventh and eighth years of school	344	1 169
3) Ratio, (1)/(2)	35	40
B. Four years of high school		
1) Additional lifetime earnings over that of individuals with 8 years of elementary schooling	\$25 000	\$70 000
2) Costs of four years of high school	1 636	5 930
3) Ratio, (1)/(2)	15	12
C. Four years or more of college of university		
1) Additional lifetime earnings over that of individuals with four years of high school	\$39 000	\$151 000
2) Costs of four years of college or university	4 343	13 780
3) Ratio, (1)/(2)	9	11

/as the

as the rates of return the ratios shown in line 3) of Table 3 for each level of education.

In interpreting these estimates of internal rates of return to education, it should be borne in mind that the educational costs include all public and private expenditures entering into education and earnings foregone by mature students while attending school (as already noted earnings foregone represented about 60 per cent of total educational costs of high school and of higher education in 1958). The lifetime earnings are cross-sectional estimates and the assumption was made that the average internal rate of return was the same for each period, that is, 78 per cent for A and 23 per cent for both B and C levels of education. Let me now present estimates of these internal rates of return based on two different assumptions of the allocation of the costs of education for 1958:

	Rate of Return	
	All educational costs allocated to investment in earnings	One-half of high school and three-fifths of higher education costs allocated to investment in earnings
Fifth, sixth, seventh and eighth years of elementary school	40	-
Four years of high school	12	24
Four years of college or university	11	18

10. Education as a Measured Source of Economic Growth

In sections 1 and 2 we discussed various sources of measured economic growth. The conventional and also measured sources were land, labour and capital and among the more important omitted and unmeasured sources were economies of scale, advances in knowledge and education. Our task, meanwhile, has been to examine education in this connexion. For the United States we are now prepared to

/give a

give a qualified answer to the question: How much of the measured economic growth in recent years has come from education? Our answer, as will be evident from the estimates that follow, is that about one-fifth of it can be traced to increases in the stock of education in the labour force.

Let me make clear what is meant by the term "one-fifth of it". If the increase in measured national income were 3 per cent per annum, one-fifth of it means that .6 of a percentage point came from the source specified (20 per cent of 3 is .6). Turning to the United States, we find that between 1929 and 1957, measured income increased from 150 to 302 billion dollars in 1956 prices. Our statement with regard to education as a source, therefore, says that at least 20 per cent of this increase of \$ 152 billion, or approximately \$ 30 billion of additional national income came from improvements in the capabilities in the labour force directly connected with education.

The underlying estimates on which this inference rests are inherently simple. Basically, we need an estimate of the increase in the stock of education that has become a part of the labour force and an estimate of the average rate of return on this stock based on the increases in earnings connected with this education. We have presented elsewhere both a procedure and the estimates of the stock of education carried by members of the labour force, 14 years and older, in the United States for the period 1900 to 1957.^{21/} This stock rose from 180 to 535 billion dollars in 1956 prices between 1930 and 1957, an increase of 355 billion dollars.

^{21/} See, "Education and Economic Growth", Tables 7 through 14, and my essay "Rise in the Capital Stock Represented by Education in the United States Between 1900 and 1957" to appear in Economics of Higher Education, edited by Selma Mushkin, published by U. S. Department of Health, Education, and Welfare, Washington, D. C.

In deriving an estimate which is essentially a lower limit of the contribution that education has made to measured economic growth, we subtract from the 355 billion dollars, a total of 69 billion dollars which is the amount required to adjust for the increase in the size of the labour force in order to keep the stock of education per worker constant at the 1929 level. Thus, we are left with a rise in this stock of about 286 billion dollars in 1956 prices.

Turning next to average rate of return to education, I propose, first, to use the lowest of the rates of return presented in the preceding section, namely, the 11 per cent rate shown for higher education. Applying this rate to the 286 billion dollar increase in the stock of education in the labour force we obtain a total return from this source of 31.5 billion dollars, which represents about 21 per cent of the 152 billion dollar increase in measured income. (Note that if we were to include the 69 billion dollars spent on education to bring the stock of education of the slightly more than 38 per cent increase in the size of the labour force up to average level per worker of 1929, the contribution of education would total 39 billion dollars, or nearly 26 per cent of the increase in measured income).^{22/}

^{22/} A second estimate, substantially higher than above, is obtained by applying the weighted average rate of return to elementary, secondary and higher education. This weighted average, using the rates shown in the preceding section, becomes 19.6 per cent. Thus, we obtain about 56 billion dollars, which represents almost 37 per cent of the increase in real income between 1929 and 1957. For an elaboration of this procedure see "Education and Economic Growth", pp. 78-82 and especially Table 18, already cited. The weights I applied here are the same as those shown in the footnote to Table 18; I have, however, applied 40 per cent for elementary, 12 per cent for high school and 11 per cent for higher education as the rates of return entering into the above weighted average.

11. Some Reflections About the Relevance of This Treatment to Latin America

It has not been possible to bring this study to bear directly on education in Latin America, much as I have wanted to. The data available to me are still too fragmentary,^{23/} although I have presented some estimates of costs of education for Chile and Mexico based on studies underway by Yver and Carnoy. What I propose to do in this final section is to reflect on the economic role of education in Latin America in order to set the stage for discussions of these issues and for the kind of studies that might be most useful at this time.

1. People with low incomes are likely to place a higher value on the contributions that education will make to their future earnings relative to the value they place on the consumption components of education. Surely this is what has happened in the United States, for example, in type of institutions and courses of study that college students from lower income homes have entered upon. Their main concern has been: What could they do after they had completed school that would increase their earnings as engineers, agronomists, chemists, and the like. The strong tendency of parents, when agriculture was still a relatively large sector of the economy, to keep their children out of school to work is also an indication of this motivation, because, as I have noted earlier, the increase in earnings from attending school was clouded with uncertainty and because the contribution from the work that the children could do on the farm was immediate and assured.

^{23/} See William Benton, for an informed critical review of education, as the key to Latin America's future, in The Voice of Latin America, reprinted from the 1961 Britannica Book of the Year, 1961.

/2. In reckoning

2. In reckoning the real costs of education, earnings foregone by students while attending school are likely to be even more important in low income than in high income countries. The reasons are fairly evident. Parents in low income countries are more dependent upon the work that their children can do (thus on their earnings) than are the parents in high income countries. This view is consistent with what already has been said in "1" above. Another reason arises out of the fact that in most low income countries that are achieving a substantial amount of economic growth, the earnings of skilled workers are as a rule higher relative to the earnings of unskilled workers than it is in high income countries. Thus in relative terms, students with useful skills that they have acquired once they have completed one or more years of secondary education and especially students attending schools of higher education will have to forego more earnings relative to their job opportunities than will students in high income countries relative to their opportunities.

3. Another factor in the costs of education is the "supply" of teachers. With respect to this factor, the advantages run in favour of low income countries, provided they are prepared to employ women as teachers especially for elementary schools. Even a cursory examination of the sources of teachers, strongly suggests that in order to have universal elementary education a country must induce many women to become teachers. The recruitment of women to teach would represent a net addition to the labour force in most low income countries. Thus, the potential (female) teachers represent an untapped resource. This particular attribute of the supply and (national) real costs of teachers in expanding and achieving universal education, deserves careful attention in programmes to win a higher rate of growth in low income countries. In some of these countries, one finds formidable cultural barriers to the recruitment of
/women to

women to teach, and where this is the case, it becomes a matter of reckoning the value placed on such cultural arrangements against their costs in terms of not having teachers.

4. Further with regard to the costs of education, there is the question: Is it cheaper to import or to produce the education within the country? This question, of course, has no relevance to elementary and very little to secondary education. It applies to particular instruction and research connected with higher education. The education under consideration may not be available presently in some low income countries. No doubt, however, it could be developed and, then, the question is, would it be cheaper than having students go abroad for this education? I am of course aware that low income countries differ greatly one from another with respect to the circumstances that bear on this issue. Like the gains to be had from trade, it all depends upon the relative endowments and capacities expressed in the relative prices of factors and products. Nor is it necessarily either one or the other as a rule, for both imported and home produced skills may be advantageous, each serving different skill requirements. No doubt Mexican nationals working in the United States gain much from the on-the-job training that they acquire. Meanwhile, many higher skills can presently be had by Mexicans more cheaply at home than abroad by attending one of their own technological institutes.

5. The factors that determine the return to education are complex and all too little is known about them to permit any simple generalizations. It is possible to develop a model of an isolated low income economy in which all resources at the command of the community are allocated optimally. There are some very poor communities that appear to behave in accordance with this model. In such communities, although there is very little education, the return to it is not likely to be either higher or lower than to the investment in other resources.

/The implication

The implication is that a community so situated is in a long period stationary equilibrium producing only poverty, as unfortunately may be the circumstances that have characterized Haiti. A model that would be relevant to the conditions that characterize most countries in Latin America must, however, introduce a variable for the adoption of new, useful knowledge presently available to these countries both in techniques of production embedded in the quality of modern capital goods and in skills and knowledge of people. The introduction of this variable is likely to indicate a relatively high rate of return to the investment in this set of superior resources.

6. It appears plausible to me that there are already situations in parts of Latin America and that these situations will become more frequent and important during the next decade or two, in which the economic growth is such that investment in education will show up as a critical investment variable. The formulation of the optimum rate of investment presented by Horvat^{24/} which treats knowledge and skill as this kind of a critical investment variable is likely to be both relevant and important in analyzing the economic growth of Latin America.

7. As the demand for new skills arises, it is all too easy to settle for crash programmes and lose sight of the need for enduring educational programmes. While there are always some demands for particular skills that arise unexpectedly which call for quick, short programmes, the basic requirements call for skills and knowledge that can best be provided by well conceived, enduring programmes of education and research. A few quickly trained mechanics to repair automobiles and trucks, or to overhaul this or that machine, or a small corps of individuals to drive tractors, keep accounts, or operate oil presses, will not fill the bill. Crash programmes are not a substitute for the enduring educational programmes required throughout Latin America.

^{24/} B. Horvat, "The Optimum Rate of Investment", Economic Journal, December 1958, 68, 747-67.

8. Among the enduring programmes, there is the question: How should the resources entering into education be distributed among the different levels of education? The leaders in many low income countries, and especially so in some Latin American countries, favour programmes to enlarge and strengthen the universities while neglecting programmes to extend and improve elementary and secondary education. When one takes a long view, as one must in investing in human capital, the really large pay-offs are likely to be precisely in the areas that have been so grossly neglected. Let me also note here in passing that one of the strongest arguments for land reform throughout some parts of Latin America is in the fact that it could become a means of getting farm people out of the illiteracy trap in which so many of them are caught.

9. In closing, let me return to the basic economic issue, pertaining to the under-investment in education. There are several reasons for believing that under-investment in education in human capital generally is the rule throughout Latin America. What is implied here is that when we take account of both costs of and returns to investment in the capabilities of people, education is both a strong source and a relatively cheap source of economic growth. The term cheap as I use it here means that the rate of return to education and other forms of human capital is high relative to the rate of return to other sources. Nevertheless, in many countries, the traditional view is that expenditures to improve the labour force have a low priority. Increases in the stock of conventional capital have been rated much higher.^{25/} The reasons given in support of this view are, however, subject to much doubt. For example, the traditional view holds that education is only consumption and, therefore, the natural order is, first, to develop a more productive industrial and agricultural plant consisting of

structures, equipment, inventories, roads, harbors, and irrigation and other installations to improve the land, and then out of the resulting increase in national income, to spend more on education. A country must keep the horse of production ahead of the cart of consumption, so the argument runs, and some history is cited in support of this sequence. During the early industrialization of western Europe, plant and equipment came first and education followed. Labour was abundant, although mainly illiterate and unskilled. Programmes to improve the skills and health of workers were not necessary for this important phase of the industrial revolution. Why are they necessary in low income countries today? But the analogy is misleading because countries now entering upon industrialization would act like economic illiterates to try to adopt only the simple, primitive, techniques of production of a century or two ago. Nor could they do so even if they were foolish enough to try, because such techniques are now mainly collectors' items, available only in our museums. The abundance of a modern agriculture and industry is not to be had by a people who are predominantly illiterate and unskilled. Education and knowledge are indeed an important variable in the rate of economic growth that low income countries can achieve.

Those who nevertheless hold to the traditional view, also, stress how few skilled people can be employed in agriculture in any low income country because agriculture is so backward in such a country, and, therefore, cannot employ trained people. Much, too, is made of the "unemployed intellectuals" in low income countries, and of the fact that the early large movement of capital from western countries to the then low income countries was employed to build harbors, ports, railroads, textile mills, a few factories and to develop many plantations and not to build and operate schools. Since I have examined these and still other

/arguments in

arguments in my Owens Foundation lecture, I shall not repeat them here. ^{26/}

26/ "Investment in Human Capital in Poor Countries", a lecture given at Southern Methodist University, April 26, 1961 (to be published by the Department of Economics of Southern Methodist University) Inasmuch as this lecture is not yet available in published form, let me quote two paragraphs from that paper: "A substantial literature exists which claims that there are many "unemployed intellectuals" in most poor countries and this literature goes on to emphasize the social stresses and political dangers inherent in increasing the number who are so unemployed. Clearly, there also are some students who, upon their return from their studies abroad, find it hard to obtain work that will put their new skills and knowledge to good use. Education in this context, so it is argued, is a luxury that a poor country can ill afford. The real issue underlying these situations would appear to be whether the skills and knowledge that these intellectuals and returning students possess are of the type that are useful in economic endeavour and appropriate to the economic circumstances of these countries".

"Still another belief about when to invest in people goes back to the uses that were made of the large movements of capital from western countries to less developed countries. This capital was used to build harbors, ports, railroads, textile mills and some factories and to develop many plantations. It was not used to build and operate schools. It is clear, however, that this capital as a rule increased production substantially. Are there any reasons why imported capital used for similar purposes today will not give fully as satisfactory results? The central issue here turns on who is to run these new establishments once they have been constructed. In general, competent European personnel accompanied these earlier capital exports and proceeded to run the enterprises that emerged. This arrangement is now unacceptable to most of the poor nations acquiring capital from abroad. Who, then, will step in and run these new port authorities, power installations, railroads and, above all, the many plants equipped with modern machinery? The lesson to be drawn from recent experiences clearly indicates that it is much easier to build and construct than it is to develop qualified people to operate and manage such establishments".

/There are

There are indeed strong reasons for believing that most low income countries are underinvesting in human capital. These reasons are based, among others, on the causes for the poor results from economic assistance to these countries compared to good results from the Marshall programme for Europe, from the low rate at which low income countries can absorb additional amounts of foreign capital for plants and equipment caused by an imbalance arising out of the fact that too little is being spent on personnel to operate and manage these new enterprises, and from lessons that emerge from the cross-currents in world agricultural production. In Asia, India, notwithstanding her many efforts to increase food production, is not doing well whereas Japan with two to three times as dense a population and relatively much less land per person for farming is expanding her food output rapidly, becoming, of all things, self-sufficient in rice last year. Similar perplexities are to be seen in Latin America and throughout Europe, including Israel. Those countries that have the best records have not won them because they have the best land, or mainly because they have increased rapidly the reproducible capital in agriculture, but largely because they have acquired the skills and knowledge required to develop a modern agriculture.