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A Note on Education and Investment Alternatives
in Developing Countries

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The main issues to be discussed in this paper are a) what are the alternative production and investment structures as for the agricultural and industrial sectors for a developing country in the early stages of modern economic development and b) taking these structures for granted what will the consequent requirements from these two sectors be on the educational system? The term educational system is here interpreted as broad as possible. Needless to say the discussion is limited to only economic goals, which for an economy with limited investment capacity tend to be put on a higher priority than social and other goals. Finally some unorthodox ideas on what type of aid to give developing countries are suggested.

In order to put these issues in the proper perspective, I should like to state a few major economic problems facing developing countries today. In both an absolute and a relative sense they have a too low income or production per capita and in most cases also a too low rate of economic growth to achieve a satisfactory level of per capita income within a few decades.¹⁾ To acquire a substantially higher growth rate an extraordinary amount of resources has therefore to be devoted to investments. Some of the economic structures thus gained may for a period of time be of little use for the economy in the sense that they do not then add much to output. The economy experiences in a short run an overinvestment in some structure while at the same time there might be underinvestment in others. Considering the general scarcity of investment resources in relation to the desirable growth rate, it becomes very important for a developing country to invest in the "right" kind of economic structures at the "right" point of time. Analytically the existence of an excess supply or demand of certain types of capital - human or non-human - may well ex post indicate a bad structure of investments and, thus, give some hints on how to get a better resource structure. This is unfortunately not always true, since an abundant availability of some resources might in some cases lead to the establishment of production, even if it could require a long period of time before such a reaction is induced. Since it must in general be hard to invest at the "right

point of time, it is worth while to choose deliberately an investment structure, which is biased towards overinvestments in structures of critical importance for the rapid development of industrial and agricultural production.²⁾ What help in choosing such an investment structure can available analytical methods offer?

To choose an investment structure: some analytical problems

One theoretically desirable and empirically used method from which the structure of investments can be determined is the method of calculating long run expected rates of return on capital of different kinds and then using these rates to determine the economically most profitable investment structures. In practice, however, these rates of return have to be approximated with rates based on current prices, current interests and current wages, some of which may be heavily influenced in the future by the investments and by the development process itself.³⁾ More serious perhaps is the fact that these figures may be biased by the business cycle, temporary structural imbalances - planned or unplanned - in some markets, etc. Empirical difficulties of a similar kind seem to be a characteristic also of other possible methods, for instance linear programming methods and input requirement methods.⁴⁾ Such shortcomings can be attributed to the fact that most methods operate with assumptions based on an empirical situation prevailing, at best, only in developed countries, for which it may be more reasonable to assume a functioning market or price mechanism. Even though these problems are rather serious they cannot be avoided and a careful and selective use of the above mentioned methods can certainly give some valuable information. It seems obvious, however, that they are more appropriate for short or medium term problems than long term ones.

Since education at least to higher skills in itself is quite time consuming, to which, furthermore, has to be added the considerable time needed for the organization of the school system, etc., the planning period has to be at least ten years long. Probably twice as much is a desirable model. This makes the above mentioned methods inappropriate as analytical tools for the purpose of choosing the long run investment structure. The long planning period raises in effect difficult analytical problems in that most economic variables become endogenously determined. Such is certainly the case with the structure of the capital stock twenty years hence, since the initial stock of capital is usually relatively low. On the other hand, and this is an important but often neglected consideration, it also opens the possibility of choosing the future production structure as an integral part

of the planning model, since the constraints imposed by the present structure can then gradually be relaxed. Consequently the need for a long planning period caused by the time requirements of the educational process also increases the alternatives at hand for determining present and future investment structures. The choice of future production structure and of present and future investment structures have to be made simultaneously, but can be made on the other hand within a rather broad framework.⁵⁾

Alternative future production and present investment structures

This is not the place to go into detail about potential structures available to developing countries. A few broad outlines will suffice.

The general framework for the future production structure is set by the availability of basic factors of production such as raw materials, land for use in agricultural production and abundant supplies of labour on one hand, and potential domestic and foreign markets on the other. Knowledge about such basic economic potentialities may indicate a general direction or path along which the economy may grow. The choice of a future production structure imposes some restrictions upon

- a) the level of investment needed in earlier periods. In particular, the choice may require a high investment/output ratio or only a low one that allows for more present consumption.
- b) the structure of investments. Here one might distinguish between investments biased towards human capital, for instance in education, and investments biased towards non-human capital. Each of these two categories can furthermore be divided into two other, in that investments can be either concentrated or spread out. To be specific, this gives in the case of investments in education the alternatives to educate a few to high skill levels or to educate many to only low skill levels.

I am not going to speak much about the restrictions imposed on the investment/output ratio. Suffice it to say that it is easier to choose a high ratio, if the type of investment made also has an immediate consumption effect. This is certainly the case with investments in education.

As for the restrictions imposed on the investment structure, I have here distinguished between four structures. To make it easy for me, let me begin with assuming that each production structure has one and only one investment structure associated with it. In general then it is not very likely that a developing country could acquire a general comparative ad-

vantage in a production structure utilizing intensively either high skill classes of labour or non-human capital. Both the low initial stock of capital and the small investment resources in relation to the developed countries rule out these alternatives for at least several decades ahead. Left to be considered is then investments in human or non-human capital spread out on a lot of people or a lot of plants or farms respectively. Here I have no general arguments for or against one or the other. In practice I do not think that these are really alternative policies; it might in many cases rather be that those investments are complementary.

So far, only the general case has been considered. For some developing countries, however, alternative policies may be preferable. Take, for instance, a country with abundant raw material resources. In many instances the available production technique is relatively intensive in using both human and non-human capital, since the technique usually is developed in highly industrialized countries. The comparative advantage established by the abundant raw material gives the country another possible and usually preferable production structure. If human and non-human capital is complementary in the production of this raw material then there will also be another structure of investments needed, namely a structure including concentrated investments in a few higher skill categories of labour and in a narrow sector of the economy. The development of such an advanced sector will be easier if foreign producers in the beginning can be persuaded to bear the costs of the investments in human and non-human capital. This will initially demand immigration of skilled labour from abroad along with imports of the machinery needed. With proper planning the imports of man and machinery may at least partly and successively be substituted by domestic labour and domestically produced machinery and equipment respectively. In effect it might be possible to get some "spin-off" companies, established by former employees of the raw material producing industries and producing inputs to or heavily utilizing the output of these industries

Here I have discussed two cases of future production structures. There are, however, certain countries where both structures can be parallelly developed.⁶⁾ In many countries the agricultural sector may play a part of the role here given the raw material production. In fact the development of an efficient agricultural production could serve the purpose of establishing a much needed domestic market for non-durable consumption goods and for semi-manufactured equipment and machinery. To summarize, the early development stages may then be characterized by a production structure including a relatively large production of the following products:

- agricultural goods
- raw materials
- manufactured foodstuffs and other non-durable consumption goods
- semi-manufactured goods and parts for the agricultural, raw material and consumption goods producing sectors.

This conclusion about the production structure is far from unique, but is still worth emphasizing in that it bears important implications for the choice of educational system.

Manpower, requirements and the educational system

Apart from more highly skilled labour needed in raw material production and in organizing and leading functions of every industry, whatever the production technique, the type of production structure discussed here may be called "high skill saving". This means that the manpower needs will be heavily biased towards lower skilled classes of labour and that the educational system has to be designed to meet with those needs. For a reasonably large and at most partially developed country the scarcity of resources demands three basic characteristics of its school system in order to make the economic growth rate as high as possible:

- 1) that the investments in education can be utilized in production soon after the period of investment
- 2) that the education is not too costly for the skills gained
- 3) that the education leaves some flexibility for further education or retraining during the lifetime of a person.

Talking, as earlier, only about the needs of the agricultural and industrial sectors, this indicates a school system which is extremely oriented towards the practical problems in these sectors. In effect I believe, again only based on economic reasoning, in a primary, common school offering only the basic knowledge in reading, writing and arithmetic. After some years in primary school, the students intending to work in jobs requiring only lower skills should be directed to vocational schools in as large numbers as possible. The failure of these schools in developing countries is amply described in the literature, a failure which I believe can be ascribed to too little job oriented education.⁷⁾ If possible such vocational schools should be constructed in the form of pilot plants. In this form the basic industrial or agricultural training could be given. There production engineers, managers, foremen, etc, could also, after or parallel with their theoretical education, acquire training in practical production, organizational and instructional problems. In industrialized countries the equivalent education is mostly given on the job. In the absence of many well organized companies the developing countries have to

include such basic training in their formal school system and thus give it a much more joboriented dimension. Two positive effects may be gained. 1) The training in pilot plants may in itself serve as a catalyst to the establishment of the needed industries. 2) The existence of such training facilities and trained personnel can induce some foreign companies to set up plants in the country. To this might be added that the skills gained in pilot plants tend to be less of the plant specific kind than that given within the plant itself and are thus not totally wasted, when and if a plant is closed.

As indicated earlier, the pilot plants can be either industrial or agricultural. In both cases they serve as demonstration units and this is an especially important function in the agricultural sector, where changes tend to be slower. It is important to stress this additional function of pilot plants in a developing country, where the lack of even basic knowledge of modern production methods often is critical. Let me emphasize that there is no need initially to introduce the newest, and most capitalintensive methods of production neither in the pilot plants themselves or in the "spin off" plants that hopefully shall follow. Here again the choice of a suitable production structure can clearly substitute for the use of the most modern technique. Thus, both some investment capacity may be saved to other purposes and a higher employment effect can be gained.

I do not intend to be more lengthy on the subject of the structure of education. It is obvious from what I have already said that I believe in a very practically oriented education for students who are to work in industry or agriculture and that this should be so however high skills they are acquiring in school. This again is a consequence of the conclusion that a developing country cannot develop a general comparative advantage in production heavily utilizing highly skilled personnel. Such countries must import production techniques for extended periods of time and usually cannot hope to invent new products.

Some reflections on what type of aid to give

It is obvious that the investment structure suggested above imposes some quite unorthodox demands on the type of aid to be given a developing country that is at least as long as the dominant reason to give aid is to promote the economic growth of the receiving country. It is clearly not an easy task to set up a vocational school system in the form of pilot plants. Here

I believe that import of foreign personnel could prove to be essential. The use of foreigners in that task has the effect of both getting a suitable and efficient schooling from the beginning and shortening the period before which the first students will leave the school. In this it facilitates the fulfillment of the above mentioned characteristics of a good educational system. Apart from the needs during the period of organization of the vocational schools, the kind of educators most demanded from abroad will probably be managers, engineers, foremen, etc., formerly employed in regular industrial plants in the developed countries and preferably then those with a former occupation in the teaching organization of these industries.

Even such an ambitious development and aid program may, however, prove to be insufficient. I should therefore like to forward some further ideas on an aid program, which is still more ambitious and requires a more deeply felt anxiety in developed countries to promote the economic development of the least developed ones.

During the 1960s most advanced economies have increasingly had to face the problems of backward sectors of their industry. The backwardness of these sectors can of course in a way be looked upon as reflecting that other sectors have developed more successfully. It seems safe to argue that behind this development lies also fundamental economic factors of a macro-economic kind, for instance factor prices and proportions, production technique etc and not only microeconomic or firmspecific ones. To be more specific backward sectors seem to be characterised by low wages, low capital intensiveness, small scale and relative low labour skills. Obviously sectors of this kind are potential sectors to develop for the type of developing economies that have been discussed above and a transfer of production to those economies appears to be natural even with unchanged economic policy. It may, however, require quite a long time. In order to facilitate and speed up such a transfer the following steps should be taken:

- 1) First of all prevent the introduction of new tariffs or other protection in the developed countries for their backward sectors.
- 2) See to that when a plant is closed down its capital resources will be moved to a developing country. In specific I mean that not only the machinery but also the human capital, the skills of the labour force, should be transferred. This could be done if it is financed by the developed country or an international aid organization, to a relatively small financial cost since the equipment can be bought to its scrap value. A few of the former labour force could be sent along with the equipment to the developing country and used in the education and training of the new labour force.

- 3) Provide for that the market organization is not destroyed, but rather handed over to the new owners. This will establish an initial market for the rebuild company and a market which will earn the developing country some foreign currency.

It is important to add here that this type of aid is fruitful only to the extent that the developing country has been able to give its labour force the adequate and practical skills needed to take over such plants. This will certainly strengthen the demand for a type of school system of above indicated kind. Initially some discontinued plants from developed countries can be used as pilot plants. Provided that the here recommended types of school system and aid are successful in terms of rapid economic growth, the pilot plants can gradually be scrapped and the school system changed so as to fulfill also other goals than economic. In a way the best indication on the success of pilot plants might be that they will be less needed when the economy develops.

Certainly the type of economic aid suggested above will meet objections in the developed countries. Provided that the aid is successful it will enhance the problems of the backward sectors in these countries. Even so it can be argued that the effect on economic growth, wage levels etc. will in the long run be positive, since it will ease a) inflationary tendencies from backward sectors through increasing costs and b) the scarcity of labour and thus facilitate the expansion of more advanced sectors. More positive economic effects could certainly be mentioned, some of which will originate from the advantages of increased international specialization and of enlarged import markets in the developing countries. The long run social and political effects might, however, be of an even greater importance. Since the workers employed in the backward sectors are often those with low wages and low skills, a government financed program for reeducation and training could be set up so as to ease their reemployment in more advanced sectors, which usually require higher skills of their workers. Concludingly the suggested policy may well be an important mean to deal with the problems of poverty and low incomes not only in foreign countries but also domestically.

FOOTNOTES

- 1) At least from what can be judged by growth patterns of presently developed countries.
- 2) Provided that such an excess supply is created, it must be essential to protect it from leaking out from the country. This is, of course, especially important if the excess supply is one of highly skilled labour.
- 3) See Arnold C. Harberger, "Investment in Men versus Investment in Machines: The Case of India" published in C. Arnold Anderson and Mary Jean Bowman (ed.): "Education and Economic Development" (Chicago, 1965) or for the United States, Gary S. Becker, "Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education."

that
- 4) An indeed interesting example on the possibilities/linear programming methods give in an intertemporal analysis of the resource allocation in education in Nigeria is Samuel Bowles: "The Efficient Allocation of Resources in Education," the Quarterly Journal of Economics, May 1967. As references to the use of manpower requirement model -- Herbert S. Parnes, "Forecasting Educational Needs for Economic and Social Development" the Mediterranean Regional Project, OECD, Paris, October, 1962 and Wilfred Beckerman "Methodology for Projection of Educational Requirements" the Mediterranean Regional Project (STP - 22), OECD, Paris, 1962 (in mimeographed version) may be picked. For a more extended description of some criticism that can be raised against some of the models used in the analysis of future manpower needs, see Frederick Harbison and Charles A. Myers, "Education, Manpower and Economic Growth, Strategies of Human Resource Development" McGraw-Hill, New York, 1964, pp. 195-202. The criticism raised there is somewhat different from that made here in the text, but all lead to the same conclusion on the need for a long term plan.
- 5) These conclusions add a new dimension to the many advantages of an approach to the long term problem proposed in Harbison and Myers, op. cit. pp. 202-208 and there called "The Target-Setting Approach."
- 6) A good historical example of the existence of an advanced raw material producing sector of a relatively backward economy is the case of Sweden before the end of the 19th century. In the production of iron and steel the Swedish industry was in the forefront as indicated by inventions of new production techniques. After the opening up in the 1850s of a market for Swedish wood products in Great Britain, a new raw material sector was established. In this sector the major production technique was however imported and it was not until the 1870s and in the production of paper, another product based on wood, that this then broadened sector revealed itself to be an internationally advanced one by a new, major and Swedish technical invention.
- 7) Harbison and Myers, op. cit., p. 56 refers to such a failure in Uganda. In my judgment their conclusion on p. 68 that "concentration on vocational and craft training at the secondary level would be unwise" for the underdeveloped countries may be wise to take as an advice only if one stresses the words "at the secondary level." To me the hitherto referred

examples of bad experiences from vocational schools might as well indicate that the education and training given there is not adequate and practical. Even if the contrary is the case the failure of vocational schools might then indicate the lack of proper job opportunities. The latter could in effect be taken as implicating an even broader task for the vocational schools, which can be constructed to also include the practical training of the highly skilled labour classes. If competent teachers are not available in the underdeveloped countries, why not include the education of such teachers in the development plan and in the meanwhile try to import such teachers from abroad?