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DEMAND AND SUPPLY ELEMENTS IN EDUCATIONAL PLANNING†

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Abstract—Educational targets are usually determined by one of the conventional planning approaches without adequate prior knowledge of the behavioural relationships concerning the educational market. The insight into the functioning of the relevant demand and supply factors within the framework of an educational market can effectively serve as the groundwork and consistency check for any planning exercise. After reviewing various concepts regarding the structure of educational market, a demand and supply system of education is developed in the paper. Apart from the consideration of the relevant demand and supply factors, a novel concept of education's price is introduced. Empirical tests of this system are carried out for Africa, Asia and Latin America for two periods of time with encouraging results. Some basic conclusions can be drawn from these results particularly with regard to the changing impact of the demand and supply factors, the link between economic growth and income distribution through education, and the co-existence between the excess demand for education and unemployment.

1. INTRODUCTION

With the advance of time the process of educational planning has been refined and integrated with the overall plans. Its theoretical underpinnings have been strengthened by the application of rigorous mathematical methods such as the programming method, input–output, and Markov chain[1]. Customarily educational targets are determined by one of the following planning approaches: manpower requirements, social cost-benefit, social demand and optimum resource allocation. Sometimes even two or more approaches are used simultaneously for one single country so that targets can be made as realistic as possible. Combination of the manpower requirements approach with the rate-of-return analysis is becoming increasingly popular since the advantages and shortcomings of both methods seem to compensate each other in a well-balanced manner[2]. Recently even the optimum resource allocation approach has been added to this combination to ensure that the true or shadow rates of return are calculated and the benefits of education maximized[3]. In most of these cases educational targets are based primarily on the external efficiency of the educational system in catering for the demand for various categories of educated persons. The structure of the educational system itself is relatively less analyzed so that the behavioural relationships concerning the educational market are not sufficiently known. This is certainly unfortunate since the insight into the functioning of the relevant demand and supply factors within the framework of an imaginary educational market can effectively serve as the groundwork and consistency check for further planning. This does not imply that past trends have to be projected into the future or that unplanned figures of one country are to be used in making plans for other countries. On the contrary, by learning from past experiences, clearly brought to light in quantitative terms with sound theoretical basis, one is better equipped in preventing past defects to reappear in the future or in promoting favourable trends from the past. The purpose of this paper is to draw attention to this relatively neglected part of educational planning. We shall commence by reviewing some theoretical and empirical work in the field of demand and supply of education. Then we shall proceed to present a simple theoretical demand-supply system of education from which several possible relationships can be derived. We shall conclude by discussing the empirical results for Africa, Asia and Latin America, to which a reflection on the problem of unemployment and overeducation in most developing countries will be added.

2. A REVIEW OF VARIOUS CONCEPTS OF THE STRUCTURE OF EDUCATIONAL MARKET

Educational plans, though designed with care, would only be viable and meaningful if they had a fair chance of being implemented accordingly. Elusive plans that are not infrequently doomed to obscurity—most likely because of their being too impractical to be implemented—would have stood a better chance if enough circumspection had been paid to a thorough analysis of other empirically relevant aspects alongside the process of plan formation. This section is intended to provide some understanding of the various concepts which deal directly or indirectly with the "positive" side of the planning process. Quite an extensive ground should be covered by adhering to a broad classification emphasizing: (a) the demand side of education; (b) its supply side; (c) the development of the educational system over time.

(a) Demand for education is often divided into two distinct types, the consumption demand as portrayed by the social demand approach, and the investment demand as taken up by the rate-of-return approach. This distinction reflects the different manners in which educational targets are set. The first approach puts emphasis on the input side of education, namely the flow of pupils between classes and the population growth, while the

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latter considers the final output of education in terms of years of education and additional earnings. But since these are norms used in setting targets we shall have to leave them alone, for we intend to view the educational market as a whole. Empirical work and theoretical underpinning in this area are unfortunately subject to an unsound definition of demand which renders the results less credible. In most cases demand for education is defined as the actual enrolment ratio or the number of enrolments which is not the true demand but the realized volume of education. This volume can only be derived at after the roles of the demand and supply factors are played out in the market.

In a study on the economics of human resources Correa concludes that "income is one of the principal determinants of the demand of education"[4]. This conclusion may be theoretically correct but is by no means supported by his empirical finding. For one thing, the result cannot be conclusive because no allowance is made for other explanatory factors besides income. In other words, Correa's simple regression between the percentage of the 5–14 age-group enrolled and the per capita income should rather be interpreted as empirical proof of the positive relationship between a country's volume of education and its level of welfare, no more and no less. Besides what he uses is not the demand for education but the realized volume of education. Similar definition has also been used by Galper and Dunn Jr.[5] who define demand for college education as college enrolment. This leads them to use only demand factors as highschool graduates and family income in their so-called demand function while supply factors are more or less disregarded. Only an institutional factor is added to demonstrate why the demand elasticity between college enrolment and highschool graduate must be less than unity.

In another American study by Brazer and David[6] on social and economic determinants of the demand for education, the demand is defined as educational attainment—viz. the average number of grades completed. The authors themselves admit that the analysis would reflect not only the demand for education but also the supply of educating facilities available to children as well. But Brazer and David only look for motivations and not for explicit relationships. In so doing they find that the head of the family's education indicator makes the biggest contribution to the explanation of educational attainment. This finding is of importance in itself but does not contribute to the understanding of the dynamics of the educational system which forms an essential part of the educational plan. Again the definition of the demand leaves much to be desired. Besides, this theoretical framework can be of limited use for educational planning in developing countries. The situation there is such that the supply of education plays a dominating role which can simply not be disregarded. This is one of the reasons why one should consider both demand and supply factors especially when dealing with education in a developing economy.

(b) It is common to describe the supply of education in terms of the public expenditure on education. Edding[7], for example, considers this expenditure to be a very good measure, perhaps even the most comprehensive and simplest measure of educational effort, although he agrees that educational expenditure as a percentage of GNP should not be used for international comparison. His main contribution is in analyzing the components of educational expenditure. He gives an example of the trend of educational expenditure in the United States, showing that most of the increase is due to the increase in teachers' real salaries and price inflation. This is certainly true for developing countries as well. Hence the number and type of teachers may be the revealing real factor in describing the effort to supply education. This fact will be used by us in constructing the supply function for education.

Another interesting discussion on public expenditure on education is that by J. Vaizey[8] in his paper "Criteria for Public Expenditure on Education". As Vaizey considers that the one important factor in increasing the demand for education should be the supply or provision of educational facilities by the government, he concentrates on the criteria that public expenditure on education should meet the public interest in demanding education as consumption and investment. Vaizey also points out that attention should be paid to the study of the internal logistics of education, viz. the inter-relationships within an educational system. This conforms with the main principle on which our demand-supply system will be based.

(c) Besides empirical work which views the educational volume either from the demand or supply side, a group of educational flow models has been developed which deals with the educational system as a whole. These models can be devided into three categories: (1) ordinary student flow model; (2) educational input–output model; (3) Markov-chain model.

All these models possess one common disadvantage. They all work with fixed technical coefficients such as the passage, repetition and graduation coefficients in the first category, and transition ratios in the last two. Even Thonstad who favours the Markov-chain model admits that his matric multiplier can be only of limited interest since the transition ratios will surely change over time:

"The most important objection to the transition type of analysis is probably that the transition ratios are determined by the pupils' behaviour as well as by the rules and decisions of the educational institutions. To take an analogy from economic theory: *The transition ratios are neither "demand" nor "supply" parameters, but rather a mixture of both.* For some school activities, the demand for places exceeds the capacity by very much, so that the transition ratios are very strongly influenced by the capacity limit. The transition ratios, therefore, may turn out to be very sensitive to changes in the policy of the school authorities"[1(b), p. 63].

This statement is strikingly similar to what Stone says about the problem of projection and changing coefficients when applying the input–output model:

"The future numbers in the different states of the system depend partly on demographic changes and partly on changes in the structure of the system, which can be expressed as changes in the transition proportions. *These proportions in turn depend partly on supply and partly on demand conditions.* For instance, there may be an increasing demand to remain at school beyond the age of compulsory education; but this demand will be effective only to the extent that the supply of school places is increased"[1(a), p. 113].

Both statements clearly demonstrate the controversial characteristics of the transition coefficients. Although they are technical, they are the result of the demand and supply effects which are rather sensitive and variable and have overwhelmingly behavioural characteristics.

3. A DEMAND-SUPPLY SYSTEM OF EDUCATION

In the preceding section we have noticed that attempts to construct a complete system of demand and supply as such in order to explain the educational volume has been rather scarce. On the one hand, demand and supply effects were as a rule dealt with separately from one another, often with inadequate specification regarding the factors on both sides. On the other, technical relationships frequently applied nowadays conceal the main driving forces of demand and supply behind them. In this section we shall discuss a bunch of demand and supply factors which form the essential elements of our demand-supply system. We are thus concerned mainly with the explanation of the realized volume of education in a way which is theoretically sound and can be substantiated empirically. The system is constructed simply around the following factors: (a) demand factors; (b) supply factors; (c) the regulatory element of education defined as "weighted benefits".

(a) The following demand factors are found to be important enough to justify their introduction into the system:

(1) *The flow of pupils from lower educational level*

This variable represents part of the internal dynamics of the educational system. The potential demand originates from those who are qualified thanks to their having successfully passed education of a lower level. This is also one of the basic principles of the social demand approach and other educational flow systems. This factor has a lagged positive influence on the demand for education because of the lapse of time needed before an enrollee of a lower level is able to demand enrolment in a higher level.

(2) *National income level*

Just as in ordinary demand-supply systems of marketable goods, this variable clearly has a positive influence on the demand for education. But due to the specific characteristics of the educational market which will be apparent in our demand-supply system, the ultimate influence of the income growth on the growth of realized volume of education does not have to be positive too. To clarify this point it is necessary to bring in the supply function which must also take account of this income variable.

(3) *Population growth*

This typical demand factor in the educational market directly influences the demand for primary education. For secondary education this variable can function as a distant signal of demand to be expected. Although this influence resembles that of the student flow mentioned above, this population growth factor carries with it some extra information. In explaining the growth of the realized volume of secondary education which will be our main test case, this factor can switch over to a negative role. This piece of information is important in that it reflects the competitive roles played by the primary and secondary education in the total educational budget. Particularly in developing countries with a small volume of primary education and high population growth the resource allocation for different levels of education must be shifted in favour of the lowest level of education.

(4) *The degree of utilization of educating capacity*

This is defined as the adjusted proportion between the number of enrolments in primary and secondary education and the population in the appropriate age-group. With an eye to the tests with educational growth, this factor indicating the level of potential demand for places at the initial period may prove to be useful. The more pupils there are at the time, the more demand can be expected by: (i) Primary school pupils going to secondary schools. (ii) Secondary school pupils continuing their education.

Similarly to the population growth factor, the ultimate effect of this variable on educational growth in the reduced-form equation tends to be negative. Since this variable can also be regarded as a kind of indicator of the degree of utilization of educating capacity seen from the input or demand side, the negative effect will be caused by the existing pressure on the educational budget in the initial period. The additional educational growth will be obtained less easily and hence the smaller the idle resources the higher the degree of utilization. This variable will be particularly relevant in countries where a reasonable educational volume has been reached.

(b) For the supply side the following variables are relevant:

(1) *The flow of pupils from a lower educational level*

The "inner dynamics of an educational system" does not only have to exert themselves through the demand side but can effect supply as well. Even if a country has no systematic educational planning, it will anyhow be easily understood that as soon as the volume of an educational level is expanded there will be a subsequent impact through an increased flow to a higher level. It is due to this inevitable fact that the supply of education must be taken into account.

(2) *National income level*

The national income growth capable of stimulating the demand for education can also influence the supply of education for two obvious reasons. One is that the growth of national income enables the government to have more means of financing the educational outlay at its disposal and so can step up the supply. The other is that income growth will normally generate an increasing need for different types of labour (e.g. more highly skilled technicians), which will in turn stimulate the desirable supply of educated manpower. This in a way complies with Verdoorn's law which states that with a higher rate of growth of output, both productivity and employment increase at a faster rate. Levels of productivity and employment can be enhanced if the increase in the supply of education is sufficient and well-planned.

(3) *The availability of teaching staff*

This is purely a supply factor and needs no introduction. It should, however, be added here that this variable will not be used in the technical meaning normally seen; that is, there will be no assumption that the teacher elasticity of educational volume is equal to unity as is often implied in the technical equation of student flow models:

$$N = QT \tag{3.1}$$

where N represents the number of students of an educational level; T number of teachers of the same level; and Q student/teacher ratio; implying:

$$\frac{\Delta N}{N} = \frac{\Delta Q}{Q} + \frac{\Delta T}{T} \tag{3.2}$$

with the teacher elasticity of educational volume equal to unity. This assumption is too restrictive and is therefore refuted by the results obtained from our demand–supply system.

(c) Various definitions for the price of education have been given in various studies. They mostly have one common feature in that the costs of education such as fees, equipment, etc. are used as the measure of rationing or equilibrating in the educational market. This conventional method of defining price is not very functional in the case of education. Since education can be considered as a cause of national importance its price defined as the amount to be paid by the buyer or to be received by the "seller" loses any touch of reality due to the distorting effects produced by all kinds of subsidies. Although demand and supply of education can be limited because of high costs, they do not represent the ultimate allocating factor. Price defined as such does not stimulate supply in any way and would certainly fail to convey the information from the demand to the supply side and vice versa. Education's price cannot be increased just because excess demand persists but only because the social benefits from that type of education do not warrant sacrificing resources in order to keep that kind of education cheap. For certain types of education where supply is abundant (e.g. because costs are low), lowering "price" would not help in inducing greater demand if the subjects taught and jobs resulting from such education are detested by pupils. All in all, it seems more logical in the case of the educational market to introduce another definition for education's regulator. *Since education is mainly supplied and sought for purely because of its benefits (in economic, cultural or other senses), education's price can better be indicated in terms of its benefits.* These benefits must include not only the direct pecuniary returns in terms of additional earnings and the like, but also the indirect benefits in terms of status leading to other fringe benefits, job satisfaction, chances of gaining quick promotion, the prospect of continuing education at a higher level etc., which are of great importance in most developing countries. Therefore we shall dub our education's price "weighted benefits" since both direct and indirect benefits—after the indirect benefits are measured in pecuniary unit—will have to be weighted to form one single regulator in the educational market.

Regarding developing countries, earnings of people with secondary education are rather low, similarly to the general wage level, and compared with earnings of people with higher education who have plenty of chances of fringe benefits. In these countries excess demand for secondary education persists because—apart from the slowly growing supply—of the great weight people attach to indirect benefits. Thus in such economies, the weighted benefits are relatively high, and considerably higher than the normal direct benefits. The weighted benefits of secondary education therefore largely exceed the ordinary real wage of people with secondary education. Apart from lagging supply, the excess demand for secondary education can be attributed mainly to these exaggerated weighted benefits. Similar arguments can be put forward to explain excess demand for university education. It is this wage illusion effect that impels the demand for education in the developing countries to the point that it cannot be fully met by the supply. The resulting effective demand and actual supply at the point of equilibrium is brought about only by the interaction of factors from both sides.

Admittedly, the relationship between the weighted benefits and the supply of education is not as clear-cut as in the demand case. The government's supply of education has basically different motivations and aims, considering education as a merit good. Nevertheless, the relationship between the supply of education and its weighted benefits should not be altogether ignored. In normal cases it can be safely assumed that the positive effect of these weighted benefits on the demand is larger than its positive effect on the supply. Although a zero supply elasticity with respect to weighted benefits is possible, this limited case is too rigid and will be referred to only as a comparison with the case of positive elasticity. The special case of negative supply elasticity with respect to weighted benefits deserves a specific attention and will be alluded to in Section 5.

In algebraical terms, the demand–supply system for secondary education looks as follows:†

$$N_{2S} = \alpha_0 + \alpha_1 T_2 + \alpha_2 N_{1(-t)} + \alpha_3 Y + \alpha_4 B_2 \quad (3.3)$$

$$N_{2D} = \beta_0 + \beta_1 P + \beta_2 N_{1(-t)} + \beta_3 Y + \beta_4 B_2 \quad (3.4)$$

$$N_{2S} = N_{2D} \quad (3.5)$$

where N_{2S}, denotes the supply of secondary education; N_{2D}, the demand for secondary education; T_2, the number of secondary school teachers; Y, the level of per capita income; $N_{1(-t)}$, the lagged volume of primary education; P, the population factor; B_2, the weighted benefits of secondary education. The reduced form equations for N_2 and B_2 are:

$$B_2 = \frac{\alpha_0 - \beta_0}{\beta_4 - \alpha_4} + \frac{\alpha_1}{\beta_4 - \alpha_4} T_2 + \frac{\alpha_2 - \beta_2}{\beta_4 - \alpha_4} N_{1(-t)} + \frac{\alpha_3 - \beta_3}{\beta_4 - \alpha_4} Y - \frac{\beta_1}{\beta_4 - \alpha_4} P \quad (3.6)$$

$$N_2 = \frac{\alpha_0\beta_4 - \alpha_4\beta_0}{\beta_4 - \alpha_4} + \frac{\alpha_1\beta_4}{\beta_4 - \alpha_4} T_2 + \frac{\alpha_2\beta_4 - \alpha_4\beta_2}{\beta_4 - \alpha_4} N_{1(-t)} + \frac{\alpha_3\beta_4 - \alpha_4\beta_3}{\beta_4 - \alpha_4} Y - \frac{\alpha_4\beta_1}{\beta_4 - \alpha_4} P. \quad (3.7)$$

Granting that the elasticity of demand relative to B_2 is higher than the corresponding elasticity of supply (since $\beta_4 > \alpha_4$), as mentioned above, these two reduced-form equations show the definitely positive effect of the number of teachers on the benefits and educational volume. The ultimate effect of the demographic factor turns out to be negative in both equations. The depressing influence of this factor on the weighted benefits can come about in a number of ways ranging from the downward pressure on the wage level to the inhibiting of the realization of the indirect benefits. The constant terms from both equations are positive, as $\beta_4 > \alpha_4$ and $\alpha_0 > \beta_0$. That with zero benefit, and when all other things are held constant, there should be an excess supply of education ($\alpha_0 > \beta_0$) is not paradoxal. When weighted benefits converge to zero or are really low, people will quickly lose interest in education. But since supply is more socially oriented, it will have to go on. This also means that supply can be influenced considerably by other factors than those seen in the system, for instance,

†We have chosen secondary education as a test case since it plays a pivotal role in most developing countries.

factors with social, cultural and institutional characteristics.

Regarding the effects of $N_{1(-t)}$ and Y, no final conclusion can yet be drawn since they are dependent on the unspecified structural coefficients. If we compare the two cases where: (1) $\alpha_4 = 0$ and $\beta_4 > \alpha_4$ and the solution for

$$N_2 = \alpha_0 + \alpha_1 T_2 + \alpha_2 N_{1(-t)} + \alpha_3 Y \qquad (3.8)$$

Table 1. Coefficients of relevant variables from the reduced-form equations for N_2

Variables		Coefficients	(1) > (2) if	(1) < (2) if	(2) > 0 if	(2) < 0 if
T_2	Case (1)	α_1	$\alpha_4 < 0$	$\alpha_4 > 0$	$\beta_4 > \alpha_4$	$\beta_4 < \alpha_4$
	Case (2)	$\frac{\alpha_1\beta_4}{\beta_4 - \alpha_4}$				
$N_{1(-t)}$	Case (1)	α_2	$\beta_2 > \alpha_2$	$\beta_2 < \alpha_2$	$\beta_4/\alpha_4 > \beta_2/\alpha_2$	$\beta_4/\alpha_4 < \beta_2/\alpha_2$
	Case (2)	$\frac{\alpha_2\beta_4 \times \alpha_4\beta_2}{4-4}$				
Y	Case (1)	α_3	$\beta_3 > \alpha_3$	$\beta_3 < \alpha_3$	$\beta_4/\alpha_4 > \beta_3/\alpha_3$	$\beta_4/\alpha_4 < \beta_3/\alpha_3$
	Case (2)	$\frac{\alpha_3\beta_4 - \alpha_4\beta_3}{\beta_4 - \alpha_4}$				

which is identical to the supply function without the benefits term, and (2) $\alpha_4 > 0$ and $\beta_4 > \alpha_4$ and the solution for N_2 is as given in (3.7), we can observe the possible sizes and signs of the coefficients of the relevant variables from the reduced-form equations for N_2:

4. EMPIRICAL TESTS AND RESULTS

The reduced-form equation explaining N_2 as derived above is estimated separately for Africa, Asia and Latin America. By grouping the data according to countries' geographical positions in making the estimations, we aim at the following advantages: (1) a more uniform cultural background; (2) more comparable standards of living; (3) more comparable statistical data; (4) the possibility of comparing and learning from alternative results for the continents considered.

The tests are carried out in terms of percentage change of the variables for the following reasons:

(1) Since educatonal planning aims at affecting some change in the educational volume and its composition over time; it should be interesting to find out how these changes come about.

(2) By using rates of change as our data we assume a certain kind of non-linearity, which seems to be more realistic. Furthermore, by working with the average annual rates of change we eliminate some inconsistencies among the international cross-sectional data. These data, besides being subject to each nation's different interpretations and standards have been gathered for various dates. In this respect, the average annual rates of change are the rescaled data, which will be more uniform.

(3) The estimated coefficients can be directly considered as elasticities. These elasticities are not outspoken demand or supply elasticities but are weighted. They are important in themselves. But should more information on the separate demand or supply elasticities be wanted, it can be obtained through these derived elasticities.

(4) Some of the primary advantages of using rates of change data are that they can reduce multicollinearity of explanatory variables. The reduction of multicollinearity will make estimates of parameters more reliable.

(5) Tests with growth rates clearly demonstrate the weakness of the widely held and obvious view which attributes growth in educational volume entirely to the growth in the number of teachers (see Section 3, par. b).

The following are the best estimated equations selected from the empirical tests:†

Africa

$$\bar{N}_2 = \underset{(0.13)}{1.51} + \underset{(0.29)}{0.40}\bar{N}_{1(-5)} - \underset{(0.13)}{0.48}\bar{P} + \underset{(0.08)}{0.30}\bar{T}_2 + 0.11\bar{Y}_{(-5)} \qquad (\bar{R} = 0.77) \qquad (4.1)$$

Asia

$$\bar{N}^2 = \underset{(0.18)}{0.99} + \underset{(0.09)}{0.33}\bar{N}_{1(-5)} + \underset{(0.04)}{0.43}\bar{T}_2 - 0.09\bar{Y}_{(-5)} \qquad (\bar{R} = 0.80) \qquad (4.2)$$

Latin America

$$\bar{N}_2 = \underset{(0.04)}{0.43} + \underset{(0.13)}{0.61}\bar{T}_2 + \underset{(0.05)}{0.16}\bar{Y}_{(50-60)} - (0.07 n_{1+2}) \qquad (\bar{R} = 0.81) \qquad (4.3)$$

where $\bar{N}_2$, average annual rate of increase in secondary level enrolment 1960–65; $\bar{N}_{1(-5)}$, average annual rate of increase in primary level enrolment 1955–60; $\bar{P}$, average annual rate of population growth 1960–65; $\bar{Y}_{(-5)}$, average annual growth rate of GDP 1955–60; $\bar{Y}_{(50-60)}$, average annual growth rate of GDP 1950–60; $\bar{T}_2$, average annual rate of increase in number of secondary level teachers 1960–65; n_{1+2}, adjusted ratio of enrolment in primary and secondary education to population of corresponding age group (1960).

On the whole, the explanation of the annual average growth of educational volume by the demand and supply factors, especially those of the internal dynamics, can be considered staisfactory. For each continent, several regressions have been tried out. The consistency in the size of the coefficients in most of these equations can be observed but their significance and reliability vary.‡ Yet, from the selected equations presented above, the essence

†The variables n_{1+2}, $\bar{N}_2$, $\bar{N}_1$, $\bar{T}_2$ are measured in one-tenths of 1%.

‡Results of the estimation are given in more detail in Panitchpakdi, Chap. 5.

of the demand–supply system, which has been are point of departure remains reasonably intact.

In Africa the effect of $\bar{N}_{1(-5)}$ and $\bar{T}_2$ were firmly positive while that of $\bar{P}$ negative. The effect of $\bar{Y}_{(-5)}$ tended to be positive but was rather unstable. This only goes to show that educational development in Africa was more strongly linked with the internal dynamic forces within the educatonal system than with the labour market and the needs of the economy. The comparitively large coefficient of the student flow variable indicates that the supply effect of this variable was relatively great compared with its demand effect. Although the absolute demand and supply of education in Africa showed complete opposite pictures, the above conclusion is obvious. The potential demand effects which should result from the vast number of primary school-leavers were not or were only partly realized for various reasons, the most pertinent ones being:

(1) The pressure to earn a living and help the family made child labour a common phenomenon in Africa. It was not surprising that many potential demanders of education had to forego the opportunity to demand more education because of this.

(2) Most African communities were scattered very far apart from one another and the degree of urbanization was generally low. This somehow rendered children's contact with schools more difficult and looser than otherwise. This drawback necessitated more effort by the potential demanders of education and consequently discourages some.

These reasons also partly explain the relatively low effect of the teacher supply. Actually, in countries where the shortage of teachers is acute one would expect teacher elasticity relative to educational volume and the resulting marginal teacher productivity to be at a rather high level.† This was not generally so in Africa. The incentives to generate maximum response to an increasing supply of teachers were not yet convincing because of the scattered location of African communities mentioned above. School locations were such that increasing facilities or supplies by means of more teachers alone would not produce the desired increase in educational volume. And expanding teaching staff without substantially increasing other facilities was the case in Africa. This certainly held back the supply effect. Furthermore, the capability of employing more foreign teachers also contributed to an extra increase in teachers which might further reduce marginal teacher productivity.

In Asia the basic demand and supply forces were also active and effective, although the corresponding intensities were different from those found for Africa. While in the latter the pressure of student flow seemed to dominate mainly because of the backward state of primary education and the lagging demand effect, this pressure was slight and rather uncertain in Asia. This resembled the situation in Latin America although the uselessness of this variable in the latter case was more clear-cut. The importance of the coefficient of $\bar{T}_2$ points to the acute shortage of teachers in Asia, considering that the student inflows there were quite overwhelming. The negative influence of $\bar{Y}_{(-5)}$ was typical of the Asian case. Considered in terms of the theoretical analysis presented above, this implied that $\beta_4/\alpha_4 < \beta_3/\alpha_3$, which can be interpreted as follows:

(1) It was obvious that the enthusiasm with which Asian parents sent their children to school implied a fairly high demand elasticity of income (β_3). This resulted in a rapid growth of private schools in Asia.

(2) Large numbers of educated unemployed in Asia must have caused the relatively small impact of expected benefits on the demand for education (β_4). Although the expected benefits still had the same attraction, the chance of attaining them had become very slim. The opposite applied in Africa where there was a chronic lack of highly skilled manpower. This guaranteed high expected (weighted) benefits and also a greater chance of obtaining them.

(3) Analogously to Africa, the difference between the supply elasticities of income (α_3) and weighted benefits (α_4) could not be so great as to offset the difference between β_3 and β_4. This condition for the supply elasticities could not be far from reality since both elasticities normally tend to be low.

The lagging impact of the weighted benefits on the demand for secondary education behind the demand impact of income—demonstrating the parents' willingness to give education—led to adverse effects on the growth of secondary education. This dilemma could be evaded by giving pupils more concrete chances of obtaining the benefits by channeling them into suitable jobs and places in higher education. On the supply side, the impact of income on supply—through α_3—could be increased not only by spending a higher proportion of national income on education but also by facilitating entry into education through a better regional distribution of schools and more financial aid to groups which did not share in the bigger national income pie. In case jobs where not available and chances for higher education were only illusory, more radical measures would have to be taken. We shall touch upon this issue in the following section.

The dominance of the supply variable $\bar{T}_2$ in Latin America between 1960–65 was more pronounced compared with the negligible role of the lagged rate of growth of primary education which, being totally unreliable and insignificant, was left out of the equation. This suggests that either the teacher elasticity of supply (α_1) or the benefits elasticity of supply (α_4) or both, were quite substantial as can be derived from Table 1. Since the benefits elasticity of supply could not be high, for the reason already given, the teacher elasticity of supply must be high. This in turn indicates a large teacher's marginal productivity (see footnote ‡, p. 343) which is typical of the situation where there is a relative scarcity of teachers. Due to the influx of pupils from primary education, Latin America seems to have to cope with an acute problem of teacher shortage at the secondary level as has been observed in Asia.

The totally insignificant influence of $\bar{N}_{1(-5)}$, which means that $\bar{N}_{1(-5)}$'s coefficient does not differ significantly from zero, implies that the ratio of the student flow elasticities of demand and supply was equal to the benefits elasticities of demand and supply. This indicates the redundancy of the student flow variable in the reduced-form equation for $\bar{N}_2$. Thus if:

†A supply function obviously has characteristics derived from an education production function. In our case the volume of secondary education can be considered as a product and the teaching personnel as an input. The quotient of these two variables will therefore be called the teachers' productivity. The marginal productivity of a teacher as regards educational output can be defined as the product of the average productivity per teacher and teacher elasticity of supply.

$$\frac{\beta_4}{\alpha_4} = \frac{\beta_2}{\alpha_2}$$

the coefficient of $\bar{N}_{1(-t)}$ in the reduced-form equation of $\bar{B}_2$ will become negative, as:

$$\frac{\alpha_2 - \beta_2}{\beta_4 - \alpha_4} = \frac{-\alpha_2}{\alpha_4} = \frac{-\beta_2}{\beta_4}$$

in accordance with eqn (3.5).

This means that a relative increase in the student flow from primary level will depress the benefits by causing among others a downward pressure on the general wage level. In both demand and supply equations, the positive effects of $\bar{N}_{1(-t)}$ are offset by the negative effects of $\bar{B}_2$ simultaneously brought about by $\bar{N}_{(1-t)}$.

From (3.3):

$$\alpha_2 \bar{N}_{1(-t)} + \alpha_4 \bar{B}_2 = \alpha_2 \bar{N}_{1(-t)} + \alpha_4 \left(\frac{-\alpha_2}{\alpha_4}\right) \bar{N}_{1(-t)} = 0$$

and from (3.4)

$$\beta_2 \bar{N}_{1(-t)} + \beta_4 \bar{B}_2 = \beta_2 \bar{N}_{1(-t)} + \beta_4 \left(\frac{-\beta_2}{\beta_4}\right) \bar{N}_{1(-t)} = 0.$$

In this case there can be no change in either $\bar{N}_{2S}$ or $\bar{N}_{2D}$ as a result of the change in $\bar{N}_{1(-t)}$.

The positive effect of the GDP growth rate on the rate of educational growth displays the implicit relationship between optimum educational mix and economic growth already found in various studies[9]. With an analysis using time-series data measured in growth terms, greater understanding has been gained of the intricate balance of educational and economic growth. The statement by Peaslee is illuminating:

"A basic criticism of Harbison and Myers is that they failed to look at time-series data, instead of simply examining country differences at one point in time. They therefore failed to note the importance for economic growth of various stages of enrolment. Looking at one cross-section they found the highest GNP's per capita associated with the countries that had high university-level enrolment ratios. They did not note that the countries with the best records of economic growth expanded primary education first, secondary education next, and university enrolment last"[9, p. 307].

In a supplementary test for Europe for the same period we have found a supporting evidence for this statement. There the impact of income growth on educational growth was substantial and significantly positive (see footnote, p. 1).

The failure of the variable $\bar{P}$ to exert and its influence directly in the cases of Asia and Latin America has been anticipated. Instead of this population growth variable, the variable n_{1+2} was influencial in Latin America where the level of educational volume was comparatively high.

The tests were repeated for another period in order to observe possible changes in the behaviour of some coefficients. Due to data constraint, these tests could only be performed for the period 1965–68 and not 1965–70 as we wanted. Since we worked with average growth figures per annum, the discrepancy could happen for so far as in the first tests we had an average from a five-year period. The inconsistency could be large if there were an accelerated growth in the educational volume in the last few years of the 1960s. This fact might explain part of the decline in the quality of the estimated equations. The main results can be summarized briefly as follows (see footnote, p. 1, Chap. 6).

(1) Normally the teacher elasticity should tend to decrease in time after education becomes more advanced, with less scarcity of teachers. Asia formed an exception with its higher coefficient of the teacher variable during 1965–68 as compared with that from 1960–65. Apparently the problem of teacher shortage became more acute in Asia. The experiences of Africa and Latin America conformed to the trend mentioned above.

(2) The lagged income growth variable produced a positive influence on educational growth in Africa and Latin America, but for the latter only in the 1960–65 period. The role of this variable was unclear in the 1965–68 test, probably because of the shortness of the period imposed upon the test. The persistent negative influence of lagged income growth on educational growth in both tests for Asia (1960-65 and 1965–68) is interesting. This partly typified the development of education in many Asian countries where expensive private secondary schools predominated in the educational market, whereas public schools offering free or inexpensive education expanded at much slower rates. This is another way of saying that the income elasticity of supply was generally low and was limited to a given class of people, whereas the income elasticity of demand, in view of the Asians' enthusiasm for education, was preponderant.

(3) The influence of the student flow variable became larger in Africa. This was favourable in that the demand impact became more meaningful and could be met by anticipated supply. In terms of elasticity this means that the student flow elasticity of suptly has increased relatively to its demand elasticity.

(4) The negative pressure of n_{1+2} gained slightly in force which is to be expected when the educational volume has increased and the unutilized educating capacity has decreased.

If we are permitted to make a careful comparison of the above results are those reached by Professor Kuznets[10] concerning economic growth and income inequality, some interesting conclusion can be drawn. In the case of a developed economy, Kuznets concludes that income inequality widens in the early phase of economic growth, then stabilizes for some time and eventually becomes narrower.

From our point of view, the link between economic growth and income distribution is considered in connection with education, for education is now generally accepted as one of the main elements in generating more equitable income distribution. Considering the above results, it can be concluded that through education income growth contributed positively to narrowing income inequality between 1960–68 in Africa, and between 1960–65 in Latin America; that it widened inequality in Asia between 1960–68 and in Latin America between 1965–68. These developments therefore indicate a different trend from that observed by Kuznets in developed countries. However, this different trend is only partially commented upon by Kuznets when he says in general terms that income inequality in underdeveloped countries may widen because of "the absence, in these areas, of the dynamic forces associated with rapid growth that in the developed countries checked the upward trend of the upper-income shares that was due to the cumulative

effect of continuous concentration of past savings; and it is also indicated by the failure of the political and social systems of underdeveloped countries to initiate the governmental or political practices that effectively bolster the weak positions of the lower income class[10, p. 24]. Through the analyses of educational growth in connection with income growth some supplementary information is thus obtained.

5. EDUCATIONAL EXPANSION AND UNEMPLOYMENT

The imbalance between the number and types of educated persons and suitable employment in most developing countries has recently become a matter of great concern. Obviously educational expansion cannot be brought about without sufficient attention being paid to the consequences of this expansion to the national economy. To expand education blindly would deprive education of its most important contribution, the betterment of mankind's well-being in the physical, and spiritual senses. If educated young men cannot find suitable jobs and are forced to remain unemployed after post-literacy schooling, frustration creeps in. If persons with a certain kind of education can only find jobs which can be done just as well by others with lower education, then this educational expansion is a waste of resources which can otherwise be used to create employment.

Our approach is not meant to be a method to decide on educational targets. It serves to show how targets can be attained and where possible bottlenecks can be found. In this manner it aids in judging whether the goals which are already determined are realistic or not, basing on past experiences. Now it is obvious that past experiences do not have to repeat themselves in the future. But the point is what we learn from the past can be used to guide the future in the way we want, not by projecting the past into the future but by showing what could happen if no action were taken.

In expanding educational volume, we have seen that both demand and supply factors can help to accelerate the educational growth, that is if supply reacts sharply to the change in the factors deemed relevant. We have dealt with the crucial case of the educational system that was growing. But then we have also pointed out the reasons why excess demand for education and the resulting unemployment could take place. In our demand–supply system this can be largely explained by the weighted benefits variable which is given a central role in the system. Several recommendations[11] have been made in order to cure the problem of excess supply of educated persons which is due to overeducation. Within the framework of the demand–supply system some measures can be introduced in the following manner:

(1) By lowering the level of weighted benefits in line with the reality. This is an adjustment along the demand curve. This can be done through a change in the earnings differential between the modern and traditional sectors, and between persons with different levels of education in the modern sector.

(2) By a switch in the allocating variable, i.e. by letting the beneficiary of education bear a larger proportion of educational costs. This should only be done for certain types of post-literacy or higher education while lower education should still be available at low costs. This change will lower the reaction by demand to weighted benefits since account has to be taken of higher costs, i.e. the weighted benefits elasticity of demand will decline. This indicates a downward shift of the demand curve.

(3) The educational authorities must absolutely base their plans of educational expansion on the social benefits of education. This can go so far as to induce the supply to react negatively to the change in weighted benefits which are composed mostly of private benefits. In other words, if education is provided in harmony with the needs of the economy and society as a whole, individual benefits must not prevail in deciding the issue. Thus when weighted benefits threaten to rise too sharply—implying that the degree of illusion concerning employment and future perspectives is becoming too great as supply of educated persons persistently exceeds demand and unemployed educated grow in number—educational authorities, the main supplier of education, must step in to bring matters into their proper perspectives by adjusting the educational volume accordingly, downwards in this case. This change in sign, from positive to negative, of the weighted benefits variable in the supply function brings about a certain kind of rotation of the supply curve. In the reduced-form equation of $\bar{N}_2$ the effects of this rotation are obvious (see eqn (3.6)). The impact of the teacher variable decreases which is favourable as already mentioned. The influence of income growth would be positive and cannot turn negative as in the case dealt with in this paper. This is very important because the measures taken by the educational authorities can ensure a more equitable distribution of educational opportunities as the earnings differentials are diminished when social benefits are given a central role in expanding education.

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