A NOTE ON THE ECONOMICS OF EDUCATION

— With Special Reference to "The Economics of Education" Edited by E. A. G. Robinson and J. E. Vaizey —

MORIKAZU USHIOGI

This voluminous work of 800 pages is a report of the conference of the International Economic Association on the economics of education held at Menthon St. Bernard in 1963. Every one of the 24 papers contained in the work is highly interesting. Even more interesting, however, is the summary record of the discussions to which about one-fourth of the book is devoted. Reading these discussions, we cannot but realize that the study of economics of education has many areas yet to be explored. Several books have been published to elucidate problems of the economics of education and discuss how to approach them. However, it has been the major problem of researchers in this field to explain the economic aspects of education, by the use of such approaches and especially on the basis of actual statistical data. This book carries the reports of the findings of research undertaken by each student based on a vast amount of data. Nevertheless, it becomes clear as one goes over the discussions that many problems remain to be solved. The points questioned throughout the book may be narrowed down to four subjects: 1) measurement of the contribution of education to economic growth; 2) measurement of the demands of industry on education; 3) cost and expenditure of education; and 4) balance between various forms of education. It is impossible to discuss all of the 24 papers. Therefore, I would like to comment on two of them which have interested me in particular. The two are the papers by Messrs. Kaser and Debeauvais. Why they have interested me is because I myself have been engaged in research similar to theirs.

Mr. Kaser's paper took up 12 industrialized market economies in an attempt to analyse the correlation between educational population and economic growth in each of the countries from the end of the 19th century through 1960. He said, "The object of the present paper does not attempt to measure the contribution of education to growth, but examines whether any educational structure is common to the experience of these countries at corresponding economic graduations." How the educational structure changes under economic growth, and whether there is any tendency common to all market economies at corresponding graduations of economic growth—these are the most attractive themes to many researchers in this field. In order to explain these questions, OECD, for example, tried a cross-sectional analysis of market economies with different GNP per head in its "Targets for Education in Europe in 1970," and researchers (for instance, F. Edding) undertook a time-series analysis of the GNP and the educational population of a given country. In his paper, however, Mr. Kaser combined time-series

analysis and cross-sectional analysis into an international time-series analysis. This is regarded as quite a novel attempt in this field, as he himself put it. As Mr. Williams commented in the summary record of the discussions, however, it is not clear what he tried to draw from his vast stock of data. Yet, the aim stated at the beginning of his paper, along with Table 13 and Figures I and II, suggests that he wanted to ascertain whether there is any common level in the educational populations among societies which have reached a given level of GNP per head. In the OECD report, "Targets for Education in Europe in 1970," Svennilson, Edding, and Elvin tried to obtain a certain regression curve by examining the enrolment ratios of societies with different levels of GNP per head in the year 1960 taken as a given point of time. From Figs. I and II, it is clear that Mr. Kaser also attempted at such a regression curve. Too many deviations, however, seem to have dissuaded him from the attempt. Then, is there not any definite relationship between educational population and GNP per head? My guess is that Mr. Kaser made two errors in index calculation which made it difficult for him to find a regression formula between educational population and GNP per head.

First, he used the ratio of secondary education population or higher education population to every 1,000 of primary education population. In my opinion, this is quite questionable, as Mr. Williams stated in the summary of the discussions. The ratio varies naturally with changes in primary education population. Therefore, I think that he should have used the ratio of secondary or higher education population to total population. The second question is that he attempted to translate GNP per head into US dollars of 1955 purchasing power. Strictly speaking, however, he did not translate into purchasing power but instead translated in terms of the official exchange rates. This seems to have raised criticism from the participants in the conference as mentioned by Mr. Williams in the summary of discussions. These two defects prevented Mr. Kaser, in my opinion, from attaining any tendency line that may exist between GNP per head and educational population. To be sure, I have been studying the same subject as Mr. Kaser's, although from a somewhat different angle. Namely, I have tried to figure out the correlation between higher education population (per 10,000 inhabitants) and GNP per head in constant prices in seven countries, the United States, Great Britain, France, Germany, Sweden, Italy, and Japan, during the period 1875–1960. My approach, however, was different from Mr. Kaser's in that I used as an index the ratio of higher education population to total population, and in that I did not translate the GNP per head in constant prices into US dollars of purchasing power at any given time, because I thought that it was considerably open to question technically to translate GNP per head into the purchasing power of a given country for the purpose of international comparison.

As a result, I found that in all the countries covered there was a fairly high correlation between higher education population per 10,000 inhabitants and GNP per head in constant prices and that the two variables took the

Table 1. ELASTICITY COEFFICIENTS OF HIGHER EDUCATION POPULATION TO ECONOMIC GROWTH AND CORRELATION-COEFFICIENT BETWEEN TWO VARIABLES

Country	Period	Elasticity Coefficient	Correlation-Coefficient
U. S. A.	1870–1960	1.43	0.94
Great Britain	1900–1960	1.12	0.77
France	1890–1960	2.32	0.96
Germany	1855–1960	1.30	0.98
Sweden	1868–1960	0.96	0.95
Italy	1875–1960	1.85	0.77
Japan	1878–1960	1.58	0.92

form, $y=a\cdot x^b$, y representing the higher education population per 10,000 inhabitants, x the GNP per head in constant prices, a and b constants respectively.

What I think is significant in this outcome is b, the constant that represents the increase in higher education population which takes place when the GNP per head increases 1 per cent. Namely, it is an elasticity coefficient of higher education population against GNP per head ($\Delta y/y=b\cdot\Delta x/x$). According to my calculation this b ranges from 0.96 minimum for Sweden, to 2.32 maximum for France (refer to Table 1). As Mr. Kaser remarks, the higher education population in industrialized societies generally increases in close relation to their economic growth. The reason why GNP per head and higher education population change in a high correlation is that, as Mr. Kaser mentions, the educational structure is subject to two social impacts in the process of sustained economic growth. First, increase in GNP per head means elevation of the consumption level in various social strata, and this, at the same time, leads to increased motivation among the various social strata for access to higher education. This process is termed a demand hypothesis by Mr. Kaser. Second, increase in GNP per head means rise in the productive activities of a given society, which in turn brings about increased demand by industry for increased higher education population. This process is termed supply hypothesis by Mr. Kaser. While higher education in an industrialized society is exposed to these two social impacts, I think that it is necessary to take account of a third factor, the flexibility of a higher education system itself. In other words, the question is the extent of flexibility to which the higher education system of a given society will vary quantitatively when faced with such social impacts. Higher education population varies under the above three interlocked factors—increased preference for higher education, increased demand by industry for higher education population, and the character of a high education system or of educational systems related thereto as a whole. According to my calculation, the higher education population in France and Italy, over an intended period of 70 to 80 years, increased at a high elasticity rate of about 2 per cent against 1 per

cent increase in the GNP per head; in Sweden and Great Britain, however, the rate was no more than about 1 per cent. The fact that the elasticity coefficient of higher education population to economic growth varies with different societies suggests that the interaction of the said three factors varies from society to society.

While I used about the same data as Mr. Kaser's, my attention was directed at the pattern of variation in higher education population in the process of economic growth, rather than at the size of educational population common to societies of a given economic level, which size Mr. Kaser attempted to discover. Nevertheless, I think that this aim of Mr. Kaser's research is a very significant one for us. In my opinion, however, no study can be sufficient unless the indices it uses include not only GNP per head but also the industrial composition of labour forces, etc. With the addition of such indices, the common size of educational population which corresponds to various economic levels and industrial structures might be found.

Next, I would like to comment on Mr. Debeauvais' paper. In his paper, he studied the educational level of all labour forces in France and measured the stock of education on the basis of expenditure invested in their education. He interpreted this stock of education as constituting a sort of investment, human capital, along with physical capital. This idea is similar to Theodore Schultz's. Instead of the conventional idea of explaining national product by two factors, physical capital and labour, furthermore, he suggested that formation of a Cobb-Douglas type function of production which adds this stock of education as a third factor might probably shed considerable light on the "unexplained parts" of increase in the national product. Namely, his method calls for use of the production function, $P=a\cdot C^{\alpha}\cdot L^{\beta}\cdot E^{\gamma}$. This approach is very interesting to me. Fortunately, a few years ago in Japan, the Japanese stock of education since 1905 was estimated by the Ministry of Education. I utilized that information to reckon in the same manner as Mr. Debeauvais. I will report my findings here as data for future research.

In his paper, "Investment and Economic Growth" (OEEC, *Productivity Measurement Review*, No. 16, 1959), Odd Aukrust formulated a Cobb-Douglas type function of production consisting of three factors, capital, labour and organization, and analysed Norway, the United States, and Finland. Namely, the formula he used was $Rt=a\cdot Kt^{\alpha}\cdot Nt^{\beta}\cdot(l^{ht})^{\lambda}$, where Rt represents national

Table 2. CONTRIBUTION OF CAPITAL, LABOUR, AND ORGANIZATION TO ECONOMIC GROWTH

	Increase in Output by 1% Increase in Capital Input	Increase in Output by 1% Increase in Labour Input	Annual Increase in Output Resulting from Better Organization
Norway (1900–55: whole economy)	0.20	0.76	1.8
U. S. A. (1909–49: private non-farm activity)	0.35	0.65	1.5
Finland (1925–52: manufacturing)	0.26	0.74	1.2
Japan (1905–60: whole economy)	0.42	0.53	3.4

product, Kt real capital (at depreciated replacement cost), Nt employment (in man-years), l^{ht} index of organization (assumed to increase by a constant rate h), a, α, β, h and λ are constants. Table 2 shows a combination of Odd Aukrust's findings and mine. Many conclusions may be drawn from these findings, but one point to be noted here is that the effect of improved organization is very high in Japan. We must not overlook, however, the fact that this model is based on the assumption that organization continues to be improved year by year at a certain rate. As Aukrust admits, this assumption is a very expedient one. Surely expedient, but it seems to have been the only method available when it comes to the question of how to define and measure such a factor concretely. There may be some other ways of overcoming the restrictions imposed by this assumption, but in my opinion, Mr. Debeauvais' proposal to add the stock of education as a third factor, along with capital and labour, is an effective method. Therefore, I used the statistical figures of national income, capital, labour, and stock of education from 1905 through 1960 to calculate the position of Japan. In this case, how to estimate the stock of education will come into question in any country. But the method of estimation used in Japan is detailed in *Japan's Growth and Education* (1964), a publication by the Ministry of Education in Japan, so I will not elaborate on it here. The result of calculation from the formula $P=a\cdot C^{\alpha}\cdot L^{\beta}\cdot E^{\gamma}$ was like this: $\alpha=0.109$, $\beta=0.318$, and $\gamma=0.498$.

This means: (1) If labour and the stock of education are constant, 1 per cent increase in capital brings about 0.11 per cent increase in national income. (2) If capital and the stock of education are constant, 1 per cent increase in labour brings about 0.32 increase in national income. (3) If capital and labour are constant, 1 per cent increase in the stock of education brings about 0.50 per cent increase in national income.

During the years from 1905 through 1960 in Japan, meanwhile, national income increased 4.1 per cent annually, capital 3.5 per cent, labour 1.0 per cent, and the stock of education 5.7 per cent respectively. Therefore, the annual national income increase rate of 4.1 per cent in Japan is composed as follows:

(1)	Increase in capital	$3.5\times0.109=0.39$ (9.5%)
(2)	Increase in labour	$1.0\times0.318=0.32$ (7.8%)
(3)	Increase in the stock of education	$5.7\times0.498=2.85$ (69.5%)
(4)	Statistical error	0.54 (13.2%)
Total		4.10 (100%)

This result indicates that about 70 per cent of the increase in Japan's income is due to increase in the stock of education. This is because during the years 1905–1960 the stock of education increased as much as 23 times in Japan whereas capital increased 7 times and labour increased two times. From this single result, however, I do not mean to claim that 70 per cent of Japan's economic growth is the effect of education. I think that the influence of education on economic growth is extremely complicated and cannot be measured in the simple framework of analysis. In explaining this complicated

mechanism, we have to experiment with many approaches, including Mr. Debeauvais' proposal. In this book, too, Mr. Denison tried to measure the contribution of education to economic growth in America by another method and applied the method to the United Kingdom and Italy for the purpose of comparison. At the present stage it seems most important to use the same approach as much as possible in analysing various societies and to elevate our theoretical level through comparing them. In this sense, it is highly significant that detailed comparative studies were carried out by Prof. Edding, Mr. Kaser, Mr. Denison, etc., in this book too.