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INTRODUCTION

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THE objective of these conference papers is to take stock of our knowledge on a subject of rapidly growing interest—the relationships between education and income and the role of the human-capital approach in illuminating these relationships. This stock-taking follows more closely than usual on the heels of a prior conference, the Universities-National Bureau Exploratory Conference on Capital Investment in Human Beings held in late 1961.[1] The expanding volume and diversity of work, stimulated in large part by that previous conference, argued for an early attempt to pull together what had been learned and to plot some of the directions that future research on this subject should take.

The rapid growth of research in this general area is remarkable, as can be determined from Blaug's bibliography.[2] Of the approximately 800 items listed, only 45 appeared prior to 1961, and another 53 appeared from 1951 to 1955. But in the next five-year period, 1956-60, almost 200 items appeared. And for the period 1961-65, almost 500 items are listed. Three mimeographed supplements listed another 300 items for 1966-67. This pattern of extremely rapid growth clearly parallels that in many of the more publicized and rapidly expanding scientific fields where discussions of the knowledge explosion are rampant. This work on education, income, and human capital spills over into a wide range of fields, among them economic theory, production economics,

[1] *Investment in Human Beings*, NBER Special Conference 15, Supplement to *Journal of Political Economy*, October 1962.

[2] Mark Blaug, *Economics of Education: A Selected Annotated Bibliography*, 1966 (also mimeographed supplements, 1966, 1967, and 1968).

public finance, labor economics, and development. Running through much of this work are two underlying themes: (1) there are important links between education and productivity—and therefore income, and (2) the role of education can be explored fruitfully when viewed as an income-generating form of human capital.

The conference at which these papers were presented was held at the University of Wisconsin in November 1968. The conference brought together a substantial number of the small but expanding group of scholars undertaking research in this area. The papers and some of the more pertinent discussion are summarized in the section below.

The opening paper by Bowles is an effort to go behind the education-income relationship so as to explore what is known about how education is produced. Bowles reasons that if education has the productivity- and income-enhancing effects that have been so widely noted, we should be able to learn through an analysis of the production function for education just what factors do contribute to increased learning in the schools. Given the absence of a theory of learning, not to mention the lack of requisite data, Bowles concentrates on examining the conceptual and econometric problems involved in estimating educational production functions. In addition to a discussion of the choice of the appropriate form of the production function, he gives extensive consideration to the measurement of output, the value-added problem, and the input structure of the schools and their associated environmental characteristics. The final pages of his paper are devoted to some applications of his ideas and draw upon data from the Equal Educational Opportunity Survey. The empirical results, for black twelfth-grade students and for Northern and Southern twelfth-grade students, are interesting in that they reveal the complexity involved in identifying the factors which explain achievement levels.

One important point raised by both discussants—Brandl and Hause—is that because school administrators may be maximizing something quite different from any of the conventional school output measures (such as achievement scores), it is going to be difficult to learn what kinds of production techniques are most effective. Indeed, Brandl goes so far as to argue that only through carefully controlled individual demonstration projects are we likely to build up the type of information

needed before we can prescribe for the schools; the conventionally used survey data will at best describe what is currently going on without telling much about possible alternatives. Hause also raises a question as to the most appropriate way to take account of the effect of previous educational experience on the kinds of inputs needed for the next stage of the educational process.

Zvi Griliches's paper has a somewhat broader orientation than Bowles's in that it explores the role of education variables in aggregate production functions. Opening with a section on growth accounting, he moves on to consider alternative definitions of the education variable and alternative production functions. This leads him to consider the appropriate level of aggregation in view of the many labor quality dimensions. The remainder of the paper explores the education-ability-income relationship in an effort to throw light on a variety of issues, among them the apparent constancy of education-income differentials, increases in the demand for educated labor, and possible complementarities between human and physical capital. Griliches offers a number of useful leads and suggestions on these various issues. He concludes that although more work must be done before we can understand the processes of production of human capital and the determinants of rates of return, we are in reasonably good shape in measuring the contribution of education.

In his comment Conlisk develops the implications of two alternative methods of including the education or human-capital variable—that is, as a separate factor versus as a labor-augmenting factor. He concludes that the latter treatment can be more easily reconciled with the literature on growth models, thereby opening up a link between growth theory and work on the economics of education and human-capital theory. Conlisk provides some additional suggestions regarding the handling of the ability factor. Nelson argues for a quite different approach to the role of education in production functions; he sees education as being important because it acts to enhance the quality of decision making rather than to increase the quantity of learning as such.

The thrust of Ben-Porath's paper differs greatly from that of the first two papers. In expanding on some of his earlier work, he examines the path of the production of human capital over the life cycle. The particular problem he focuses upon is the extent to which the accumulation of human capital affects the accumulation of human capital in the future,

given the fact that past human-capital accumulation increases the opportunity cost of acquiring additional human capital. Using the model developed, he tests it with data from an earlier study by Mincer; somewhat mixed results are obtained.

Mincer offers a number of perceptive comments on Ben-Porath's model and on the empirical test of it. In particular, he discusses some of the implications of the "neutrality hypothesis" which is embodied in the model. In addition, he speculates on the role of variable depreciation and also notes that additional human investment can extend both the age of retirement and the length of life. Thurow, on the other hand, believes that the model provides too simple an explanation of lifetime human investment patterns. He spells out what he terms the "peculiarities" of human capital and tries to show how they affect the pattern of investment. In particular, he stresses the importance of the time constraint in making the human-capital market inherently imperfect. It seems quite clear that though some progress has been made in understanding the impact of obsolescence, other lines of attack are also needed.

In addition to having an impact on growth and earnings, education also affects the distribution of income. Chiswick's paper addresses an aspect of this broad topic as he seeks to explain the skewness of the income distribution, a relatively neglected topic. He sets forth a model which shows that the distribution of schooling itself would cause positive skewness in the distribution of income. But this skewness is further accentuated by the pattern of rates of return to schooling and by a variety of other schooling parameters. He finds empirical support for his model in an analysis of data for the United States and Canada.

The discussants take issue with Chiswick on several points. Mary Jean Bowman argues that skewness is the result of a number of factors which affect the shape of the entire distribution, that some of Chiswick's empirical results are not fully consistent, and that his measure of the rate of return is not equivalent to the internal rate of return as customarily defined. Foley questions Chiswick's failure to test alternative functional forms (other than the log-linear form) and the interpretation of the residual in his regression. Finally, and most important, he sees the need for a much more detailed and well-articulated model to fully explore the role of education in affecting the distribution.

The final two papers represent a shift of orientation to the role of education and human capital in the explanation of international trade and mobility patterns. The education-income relationship, while less direct in these two papers, is nonetheless important in affecting gains from trade and the profitability of moving from one country to another.

Kenen sets himself the task of dealing with two questions: What do we know about the role of skills, human capital, or knowledge in determining comparative advantage and thereby the structure of external trade? And what are the implications of what we know and what else do we need to know? The accumulating evidence seems to indicate that skill differences and research-development variables are both useful in explaining comparative advantage. Given that the skills hypothesis appears to have a slight edge, Kenen goes on to develop some of the major questions which this raises. What determines the disparities in the amounts of skill and of physical capital possessed by different countries? Why do some countries seem to have an advantage in the acquisition of human capital? How does human capital enter the production function? The final section of the paper discusses some of the normative questions that are raised through this approach. Two appendixes expand upon the empirical and theoretical issues which are touched upon in the body of the paper.

The comments of the discussants make clear that a great many issues must be cleared away in bringing the role of human capital to bear upon explanations of comparative advantage. Both Krueger and Baldwin are concerned about the human-capital measures used. Krueger believes that the R & D variables reflect flows rather than stocks of knowledge and that the skill indexes typically used make implicit and limiting assumptions about skill-substitution possibilities. Krueger goes on to point out several critical theoretical and empirical problems likely to be encountered in pursuing some of Kenen's proposed lines of inquiry, while Baldwin presents a brief summary of some of his own research on this same topic.

The migration of human capital and its impact is the subject of Scott's paper. Actually, he focuses on the "brain drain" phenomenon—the movement of one of the most valued types of human capital, highly-educated and trained personnel—which has been a subject of increased concern in recent years. The bulk of his attention is given to exploring

the major strands of this research: the decision to migrate, the valuation of human capital embodied in migrants, and the policy questions posed by this type of migration.

Holtmann in his comments tries to throw added light on the possible importance of the "dead-weight loss" relative to the income distribution effect, to consider another aspect of the externalities problem, and to suggest some directions for future work. Sjaastad elaborates on the nature of the transfers produced through migration and on the nature of the externalities. Although like Scott in believing that little of significance has been turned up by the brain drain research, Sjaastad suggests that the change in factor proportions resulting from intentional migration and its consequent effects does merit further study.

The final paper in the volume is by T. W. Schultz whose writings and direct encouragement played such an important role in stimulating research in human capital, and more specifically, in education as a form of human capital. He discusses the problems of definition and aggregation in grappling with issues in the human capital area and touches upon some of the important omissions in the work on education as a form of human capital.

Of the topics covered by the conference, the most clear-cut progress appears in those that endeavor to incorporate education into production functions and to explain international trade patterns using the human-capital approach. This progress is no doubt attributable to a general resurgence of interest in production-function analysis in recent years and to the vigorous efforts of international economists to seek explanations for Leontief's paradox. The least understood and most difficult subject to handle analytically seems to be human-capital obsolescence and its counterpart, the process of human-capital accumulation. Much the same kind of appraisal applies to education's effect upon income distribution, although the growing and ever-richer body of survey data may make this subject more amenable to future empirical investigation. Finally, and surprisingly, the topic of international migration evoked the least interest from both a theoretical and empirical standpoint. It may be that migration *within* countries rather than *among* countries provides a more attractive entree to the subject, because it is tidier, both analytically and empirically, and because it avoids some of the political issues that so often becloud "brain drain" discussions.

The general conclusion that seemed to emerge from this conference is that though the human-capital concept provides a highly useful analytical framework for attempting to understand the relationship between education and income, our understanding of these relationships is still very sketchy both at the conceptual and the empirical levels. In part, this arises from the fact that this is still a relatively new area of inquiry, and so a great deal of work remains to be done; in part, from the fact that the data we have to work with are still quite limited in both quantity and quality. But most important of all is the fact that the underlying theory with which we work—both in economics and in related fields—is not yet rich enough and our knowledge of the underlying processes is not yet adequate to overcome some of the major stumbling blocks.

In the light of this state of affairs, the virtue of the papers and comments in this volume is that they make explicit efforts to identify the questions and issues that require analysis and, where possible, they attempt to give a notion of research priorities. There is no necessity to repeat or even try to summarize these questions here—they are best expressed in the context of each contributor's own remarks.

Any conference must necessarily limit its scope, with the result that a number of topics received little or no attention. A few of the more important research questions that need to be tackled are set out below.

1. What are the determinants of the demand for schooling? We know that for individuals there are both investment and consumption components of their demand for schooling. While considerable progress has been made in exploring the investment returns, much less is known about the more elusive consumption returns. What is the nature of these returns, how can they best be approached analytically, and, finally, how can they be measured? We seem to be equally ignorant in our understanding of the determinants of the derived demand for labor with different amounts of schooling. It is clear that, in general, employers offer higher pay to more highly educated workers, but our knowledge of what elements or ingredients of schooling make people more productive is scanty. Is it what they have learned in school, as measured by test scores? Or is schooling valuable for the patterns and modes of thought and behavior it develops in people? Or does schooling merely serve as a screening device that identifies the more able, highly motivated young people in our society?

2. What forces explain the persistence of differences in earnings and rates of return by level of schooling despite marked increases in the average level of, and some rather dramatic shifts in the distribution of, educational attainment? Many writers have commented on this point, among them Griliches in his paper. Have relative shifts in the supply of, and demand for, educated manpower been such as to neutralize each other over most of the past several decades? Or have there been offsetting shifts in age-education-earnings patterns and in the relative distribution of people in the various age-education groups? Or is it possible that we have the illusion of relative stability in the return to schooling because our data are not particularly good? As yet we know little about how the labor market for educated people works, i.e., about the interrelationships between price and quantity of labor and the nature of adjustments to market shifts.

3. Although there is much to be learned about the role of education in explaining human investment decisions and associated labor-market and income-distribution phenomena, it is equally important to inquire about the impact of education on people's decisions regarding the disposition of their incomes. To the extent that education provides people with vastly more information, their attitudes toward risk and uncertainty may be affected in perceptible ways. These changes may in turn influence patterns of consumption and savings. To what extent do savings patterns differ by level of educational attainment? How is the distribution among various forms of savings affected? What are the implications for family savings of the distribution of income over the life cycle for people of different educational attainment? In what ways are their consumption patterns affected both at a point in time and over time?

4. Closely related to the above questions is the role of education in affecting intergenerational patterns of human-capital accumulation, wealth holdings, and income distribution. Through the decision of parents to transfer wealth to the next generation via the purchase of more education, rather than via cash gifts or bequests, there may have been a speeding up of intergenerational transfers. If so, this has no doubt affected the distribution of income and wealth among generations as well as the relative shares of wages and nonwages. With the growing availability of income and wealth data, it should soon be possible to begin probing these relationships.