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on the other hand, rise initially more sharply and longer, the greater the investment. So the magnitude and extent of the initial dissavings would be greater for cohorts with more human capital.

Since an initial period of dissavings would result in an initial decline in nonhuman capital, an increase in indebtedness, or some of both,³⁴ the large secular increase in human capital should have caused a secular increase in household indebtedness. Therefore, the observed increase in consumer credit and other debt may not have resulted simply from an increased demand for durables or from improvements in the market for credit, but probably also was a disguised effect of the secular increase in education and other human capital.

A change in the rate of population growth would probably change aggregate, although not necessarily social, savings because the relative number of persons at different ages would be affected. If savings rates were always greater at younger than at older ages, an increase in population growth would increase the aggregate savings rate. Such would tend to be the result in a world of unskilled workers because they would save more throughout the labor force period than during retirement.³⁵ Skilled workers, on the other hand, would have low and even negative savings rates at the youngest ages, and a larger population growth rate might actually reduce their aggregate savings rate. Therefore, the secular increase in human capital should have reduced the positive effect of a higher population growth rate on aggregate savings, and might even have led to a negative effect.

³⁴ Consequently, one can say that investment in human capital is substituted for investment in other capital.

³⁵ This essentially is the model assumed by Kuznets in his discussion of the effect of population growth on aggregate savings. See his *Capital in the American Economy: Its Formation and Financing*, Princeton for NBER, 1961, Chapter III. Also see Modigliani and Ando in *American Economic Review*, March 1963, pp. 59-60.

CHAPTER VIII

Summary and Conclusions

I. Summary

Most investments in human capital—e.g., formal education, on-the-job training, or migration—raise observed earnings at older ages, because returns are part of earnings then, and lower them at younger ages, because costs are deducted from earnings at that time. Since these common effects are produced by very different kinds of investment in human capital, a basis is provided for a unified and comprehensive theory. The analysis in Part One starts with a discussion of specific kinds of human capital, with the most attention paid to on-the-job training, because the latter clearly illustrates and emphasizes the common effects. This leads to a general theory applying to any kind of human capital.

The general theory has a wide variety of important applications. It helps to explain such diverse phenomena as interpersonal and interarea differences in earnings, the shape of age-earnings profiles—the relation between age and earnings—and the effect of specialization on skill. For example, because observed earnings are gross of the return on human capital, some persons earn more than others simply because they invest more in themselves. Because “abler” persons tend to invest more than others, the distribution of earnings would be very unequal and skewed even if “ability” were symmetrically and not too unequally distributed. Further, the conventional practice of adding returns to and subtracting costs from earnings would be very steepen age-earnings profiles and to increase their concavity as investment in human capital increases. Still another example, learning on and off the job has the same kind of effects on observed earnings as formal

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education, training, and other recognized investments in human capital, and can be considered one way to invest in human capital. Because all such activities have similar effects on earnings, the total amount invested in human capital, and rates of return on this investment can, on certain reasonable assumptions, be estimated from information on observed earnings alone.

Some investments in human capital do not affect earnings because costs are paid and returns are collected not by the persons involved but by the firms, industries, or countries employing them. These investments, which are called "specific" investments, range from hiring costs to executive training and are of considerable importance. They help to explain the well-known fact that unemployment is greater among unskilled than skilled workers in the United States, for more specific capital is invested in the latter and employers have special incentive to continue them on the payroll. Similarly, incompletely vested pension plans may be used because they help to insure firms against a loss on their specific investment. The analysis further suggests that this type of investment is relatively more important in monopsonistic than in competitive firms.

Part Two investigates empirically the effect of one kind of human capital—formal education—on earnings and productivity in the United States. The basic technique used is to adjust data on the earnings or incomes of persons with different amounts of education for other relevant differences between them. Chapter IV determines the relation in recent years between earnings and college education, considering, among other things, college costs and the greater "ability" of college persons. The rate of return to an average college entrant is considerable, of the order of 10 or 12 per cent per annum; the rate is higher to urban, white, male college graduates and lower to college drop-outs, nonwhites, women, and rural persons. Differences in the relative number of, say, white and nonwhite or urban and rural high-school graduates who go to college are consistent with the differences in their rates of return.

General observation indicates that college graduates tend to be more "able" than high-school graduates, apart from the effect of college education. This is indicated also by information gathered on I.Q., rank in class, father's education or income, physical health, ability to communicate, and several other distinguishing characteristics. A few studies permit some assessment of the relative importance of ability and education in explaining earning differentials between

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college and high-school persons. By and large, it appears, ability explains only a relatively small part of the differentials and college education explains the larger part. Apparently, moreover, the rate of return from college is positively related to the level of ability since there is evidence that ability plays a larger part in determining the earnings of college than high-school persons.

Gains from college education vary not only between groups, like men and women, but also substantially within given groups. Indeed, some calculations in Chapter IV indicate that the dispersion of rates of return among white male college graduates is as large as, and perhaps larger than, the very considerable dispersion in the returns per dollar of capital among smaller corporate manufacturing firms. A large dispersion makes it difficult for any individual to anticipate his gain from education, a difficulty that is compounded by a pay-off period of some twenty to twenty-five years. This long pay-off period provides an economic justification for flexible or "liberal" education since most of the benefits would be received when the economic environment was greatly different from that prevailing at the time of entry into the labor force.

In Chapter V attention is focused on the social gain from college education as measured by its effects on national productivity. The major difficulty here, one that always plagues economists, is in measuring the benefits and costs to society that are not captured or borne by college-educated persons. All that could be done was to derive—on the basis of crude information—lower and what is best labeled "possible" upper limits to the social rates of return, limits that unfortunately are wide apart. The more reliable lower limits thus derived do not differ much from the private rates of return, but the upper levels are almost double the latter. In the same chapter it is shown that private rates of return on college education exceed those on business capital. The evidence is insufficient to decide whether this, or the converse, is true of the social rates.

Chapter VI estimates private rates of return from high-school education. Before adjusting for differential ability, these private rates from high-school turn out to be greater than those from college. But the "true" rates, after adjustment for ability, may not be, for ability apparently differs more between high-school and elementary-school students than between college and high-school students. A similar qualification applies to the crude evidence indicating that rates on elementary-school education are the highest of all.

A traditional view among economists—certainly the dominant one when I was a graduate student—is that changes in educational attainments have been largely autonomous, and that the secular increase in education has caused a decline in earning differentials and rates of return on education. Such evidence as there is, presented in Chapter VI, suggests indeed that the relative position of high-school and college graduates probably declined during the first forty years of the century under the impact of increases in their numbers. But the evidence is scattered and much less reliable than the information available for the past twenty years. The latter, presented in the same chapter, indicates that the rapid growth in the number of high-school and college graduates has not reduced their economic position. An alternative view, supported by this evidence, has therefore gained many adherents in recent years; namely, that educational attainments in good part adjust to, as well as influence, the demands of the economic system.

Chapter VII shows that investment in education in fact steepens and increases the concavity of age-earnings profiles, as predicted by the theory in Part One. Partly as an aside, the discussion also includes a critical examination of the common belief that earnings tend to turn down when persons reach their late forties or fifties; this belief is shown to be founded on an illusion, for it is based on data that do not take economic progress into account. The same chapter shows that the steepness of age-wealth profiles—the relation between age and the discounted value of subsequent earnings—is also increased by investment in education and other human capital. It is suggested that the apparent large secular increase in the peak wealth age in the United States resulted from a secular increase in the amount invested in such capital. The chapter concludes with some applications of these profiles, especially to life-cycle changes in savings, indebtedness, and consumption.

2. Future Research

I have no illusions that this study has more than scratched the surface of the research required on the economic effects of education and other investments in human capital. There is need for additional research on many different aspects of the gain from education and on other implications of the theoretical analysis in Part One. A few examples of possible research will be briefly mentioned.

Economists have been surprisingly ignorant of the quantitative effects of different kinds of ability on earnings and productivity, yet such knowledge is essential in estimating the gains from investment in human capital (and in resolving many other problems as well). The surveys utilized in this study show the feasibility and importance of determining these effects, and many more such attempts should be made in the future.

Only a limited amount could be said about the social gains from education because of ignorance about the external effects. This ignorance is closely connected with ignorance about the "residual" in calculations of the contribution of various factors to growth. Little progress can be achieved, therefore, in improving the estimation of these social gains until methods are discovered for reducing the residual.

To many underdeveloped countries the gains from education in the United States fifty years ago may be more relevant than the gains today because this country was much poorer then and many fewer persons were educated. The evidence available indicates a decline in the private gain from high-school and college education in the first forty years of the century, but a much more intensive study is required because this evidence is not very reliable. Fortunately, Albert Fishlow has already begun a study for the National Bureau of historical changes in the demand for and supply of educated persons in the United States, and his study will throw considerably more light on trends in the gains from education.

I have not tried to estimate gains to persons taking specialized programs in high school and college. Some literature is already available on the gains to various professionals, such as doctors, lawyers, engineers, or scientists,¹ and additional comparisons can and should be made between persons with B.A., M.A., or Ph.D. degrees, liberal arts or more specialized college majors, commercial or academic high-school programs, and so on. My estimates of the average gains to high-school and college persons would be useful as a yardstick to determine when gains were unusually large or small; for example, since average gains are large, the gains from particular specialties

¹ See, for example, M. Friedman and S. Kuznets, *Income from Independent Professional Practice*, New York, NBER, 1945; G. J. Stigler and D. Blank, *The Demand and Supply of Scientific Personnel*, New York, NBER, 1957; or W. L. Hansen, "The 'Shortage' of Engineers," *Review of Economics and Statistics*, August 1961.

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would have to be very large before they could be considered "excessive."²

There has been persistent interest, if little success, in measuring the differences in quality among high schools and colleges. One way to measure quality within an economic context is to relate expenditures on students and other variables in different schools to the (ability-adjusted) incomes of their graduates.³ Such studies have already been undertaken on a small sample basis,⁴ and, with sufficient persistence, additional information could be collected to expand the samples considerably.

Chapter VII presents empirical work dealing with other implications of the theory outlined in Part One, such as the shape of age-earnings and age-wealth profiles, differential unemployment, turnover of military personnel, differential pay of school teachers, and estimates of the amount invested in human capital. The theory is so rich in implications that many more could be investigated, and empirical work has already begun relating human capital to the turnover in employment of women, comparative advantage and United States exports, the elasticity of substitution between labor and physical capital, and several other problems.

Probably the most important application is to differences in incomes between regions and countries, either over time or cross-sectionally at a moment in time. The estimates presented here of the gains from education could be used to improve Denison's estimates of the contribution of education to economic growth in the United States. The major improvement, however, must await additional work on the external effects of education, work that, I fear, will be rather slow in coming.

² This yardstick has been applied by H. G. Lewis to the medical profession with extremely interesting and surprising results: the rate of return to doctors (on their additional training compared to dentists) has apparently been no higher and perhaps lower than that to all college graduates. See his *Unionism and Relative Wages in the United States: An Empirical Inquiry*, Chicago, 1963.

³ Another approach is from the cost side, and relates differences in expenditures to differences in curriculum, size, teaching staff, and other "real" inputs; in technical language, this approach in effect constructs "hedonic" cost indexes. An interesting initial study along these lines has been made by R. Calkins, "The Unit Costs of Programs in Higher Education," unpublished Ph.D. dissertation, Columbia University, 1963.

⁴ See, e.g., the study by S. Hunt discussed in Chapter IV, "Income Determinants for College Graduates and the Return to Educational Investments," unpublished Ph.D. dissertation, Yale University, 1963.

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A more immediate, and also important, application is to the personal distribution of incomes. This field has been afflicted with numerous theories that scarcely go beyond the skewness in the over-all distribution of incomes although substantial empirical material on the anatomy of income distribution has been accumulated. The theory developed in section 3 of Chapter III combines the effects of investment in human capital and differential ability, and, unlike other theories, contains many implications about income distribution. The empirical work of Mincer, referred to earlier, as well as the fact that at least three-fifths of earnings are attributable either to investment in human capital or to differential ability,⁵ is suggestive of the promise offered by this approach. I hope to present further work along these lines in the not too distant future.

3. Concluding Comments

In recent years the outpouring of work on education and other types of human capital has reached such a level that some persons have scornfully rejected it as simply another fad, while others have been repelled by a few reckless applications and by its use to justify all kinds of public policies. To those who believe in the great value of the concept, the excesses have been most unfortunate, although perhaps unavoidable. Probably no important development has ever sailed smoothly into the mainstream of economic thought.

One might, nevertheless, get discouraged were it not for the fact that peoples of the world differ enormously in productivity, that these differences are in turn largely related to environmental factors, and that the latter are in turn related to the accumulation of knowledge and the maintenance of health. The concept of investment in human capital simply organizes and stresses these basic truths. Perhaps they are obvious, but obvious truths can be extremely important. Indeed, I would venture the judgment that human capital is going to be an important part of the thinking about development, income distribution, labor turnover, and many other problems for a long time to come.

⁵ Estimated by taking one minus the ratio of the average earnings of persons with no education to the average earnings of all persons.