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ABSTRACT

Until now, the economic analysis of education has not contributed effectively to policy formation because it has failed to answer (1) the question of who benefits from education, and (2) the concomitant question of the best way to finance education, particularly postsecondary education. The reasons for this failure have been the lack of consensus among economists about the effects of educational attainment upon the productivity of the economy, and about the distribution of benefits from additional schooling. Recent discussion on these subjects is reviewed. Three sections are presented: (1) a summary of the discussion of the effects on educational attainment of productivity in the light of recent controversies surrounding the aggregate production function; (2) an analysis of recent writings on the benefits (rates of return) of educational investment and the manner in which these benefits are distributed; and (3) an analysis of the implications of these two topics upon federal policy for education. (Author/LBH)

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THE PRODUCTIVITY AND SCREENING EFFECTS OF EDUCATIONAL ATTAINMENT

By

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Joseph Froomkin

EXECUTIVE SUMMARY

THE PRODUCTIVITY AND SCREENING EFFECTS OF EDUCATIONAL ATTAINMENT

The considerable volume of literature examining the effect of educational attainment upon the level of production of a nation, or the level of individual incomes has not contributed much to the formation of policy in the financing of education. This is not surprising, because policy prescriptions do not flow directly from the research and, furthermore, the findings of the research are not unequivocal and have not generally been accepted.

For the policy analyst, interested in determining the optimum level of subsidies and the forms of subsidies to education which he may wish to champion, it would be well if theory and empirical research were to provide set answers about (1) the optimum proportion of education required by the economy, and (2) an invariant guide to the contribution of investment in education to the productivity of the economy. Unfortunately, this is not the way economics works. Frequently, the best economists can show is that the direction of variation in the contribution of productive factor under different levels of economic activity.

Empirical research, which has some relevance to education policy, has proceeded to date along two main streams: (1) an attempt to measure the contribution of education to the productivity of labor, and hence the contribution of either educational attainment or knowledge to

the national income, or (2) an analysis of the rates of return to both individuals and society from investment in education, the so-called human capital approach. The uses of both of these streams of research in policy analysis are not straightforward because the first approach has not established an invariant contribution of education to national product, and the second is difficult to interpret because of the current disagreement over the role of education in the process of explaining remuneration of workers.

In the more recent past, as the efficiency of the delivery of education by the schools has been questioned, and the additional issue was raised about the income distribution effects of education and training, the ability of existing received theory to help the policy analyst has been further reduced. As soon as doubts were expressed about the suitability of the level of investment in human capital, and suggestions were made about the possibility of over-investment in education, the possibility that educated manpower would withhold its services from the labor market until its reserve price would be met had to be considered.

The contribution of education to national income. Perhaps one of the better ways of appreciating the promise of limitation of empirical research to policy formation is to remind the reader of the impetus for that research. In the early 1960's considerable dissatisfaction was evidenced by economists because they had failed to explain the growth in productivity of the economy through conventional analyses using the

production function which involved two inputs, capital and labor. Considerable increases in the national product were not explained by these exercises.

An attempt by Kaldor, Solow, and Arrow to explain the increases by considering technological change, i.e., a change in the production coefficients, or through increased efficiency in organization (the so-called learning-by-doing) were not believed to be fully convincing, and an alternative explanation was offered by Denison that a production function should consist of three parts: capital, labor, and capital embodied in labor, i.e., the education stock of the labor force. Denison's work was heady wine to the educators, not only did education contribute to the higher earnings of the well-educated, but Denison also estimated that spill-overs benefited the rest of the labor force.

The Denison findings have since been questioned. The existence of spill-overs was attacked by Jorgensen and Griliches, and they have not been heard of since. International comparisons of investment in labor have also cast doubt on the proposition that the increase in education is a primary condition for the increase in productivity. Even more disturbing, an attack by the Cambridge school of economists about the possibility of accurately estimating capital stock in aggregate production functions has not been satisfactorily resolved, and estimates of the marginal productivity of various types of labor derived from this

type of function is now being questioned increasingly by a large number of economists.

A policy analyst who wishes to defend subsidies to education because of their contribution to productivity can no longer rely on a consensus among economists to support him.

Human investment and rates of return. A parallel set of inquiries set off by theoretical construct of Friedman to the effect that investment in education is likely to be sub-optimal because (1) it is more difficult to finance than more conventional investment in capital goods, and (2) the risks in investment in oneself were higher than that of investment in capital goods because it was impossible to pool risks. This insight was checked by Becker, who calculated rates of return to education, adjusting as best he could for ability and family status. Later, the same exercise was repeated by Mincer. Both found that the internal rate of return to education was either equal or somewhat greater than the return on capital goods.

Later research, using longitudinal data, say that of Taubman and Wales, arrived at much lower rates of return to education, of the order of 9-11 per cent. Most recently, as premiums of starting salaries for college graduates over those of high school graduates narrowed, Freeman estimated that the return to the present cohort of college graduates may be as low as 8.5 per cent.

Reasons for different levels of income. The observed higher earnings of persons with more education, especially college graduates, have been ascribed by human investment theorists to the content of education. Others have questioned this observation, and have argued that education, especially college education, confers, at least in the eyes of employers, attributes which are only incidental to the educational process. Thus, employers may use educational attainment as a substitute for testing prospective applicants, or they may feel more comfortable about channelling them into more responsible positions, since college graduates are more docile, couth or more trainable than persons with less education. Were one to believe the proponents of screening arguments, one would be constrained to devise more economical, i.e., cheaper, procedures to screen employees.

Evaluation of screening arguments. While the arguments for education as a screening device cannot be rejected conclusively, there is some evidence that unless the world of employers is absolutely irrational education does impart desirable skills. The earnings of college graduates increase somewhat faster than those with less than a college education, and one might infer that employers who may have been impressed by education credentials in setting starting salaries give bigger raises to their more educated workers because they are more productive. The argument that college trained personnel has an unfair advantage in getting jobs on

which most on-the-job training occurs may be used to counter this inference, but it is not a persuasive line of reasoning.

Also, lately, as college graduates have increasingly filled positions which formerly were held by persons with less education, their salaries, on the average, have exceeded the starting salaries of previous job holders. One might infer from this that employers did value their education, and were offering them higher wages.

The impact of credential-based testing and competency-based instruction on screening. A three-pronged examination of (1) the state of the art of the kind of testing that could be used to validate credentials, (2) the direction and development of competency-based education, and (3) the possible use of such tests by employers did not lead to the conclusion that the competency movement could make a successful attack on screening.

In the first place, current tests of professional knowledge or attributes have little credibility with employers. The results of the bar examination do not influence the job opportunities of lawyers as much as academic record and type of school attended, for instance. The development of "good" tests for a variety of jobs in the business and government sector has to be started de nuovo. In view of how little we know about what contributes to effectiveness in professional and managerial positions, it is doubtful that such tests can be constructed.

The confusion about desirable credentials for many positions necessarily spills over into the organization of experimental programs for

competency-based learning. The programs with the longest history were mounted by liberal arts colleges, with competency objectives stated most broadly, e.g., communication skills, understanding the relation of the individual and his environment. These programs, as well as another pilot program to teach the three r's, are very different from the attempts of schools to build curricula which would impart competencies for specific jobs. For lower-level jobs, such as day-care-center managers, the competency-based programs pattern themselves on mastery-learning techniques developed for elementary and secondary students. Other programs purported to develop competency-based curricula for professional occupations have been particularly slow in getting off the ground, as the criteria for competency are non-existent.

The experience of the past five years in the development of competency-based curricula leads one to conclude that the movement is not likely to be widely adopted. Liberal arts competency-based programs are likely to be adopted only in small schools where teaching orientation is stronger than disciplinary loyalties, since they require an integration of the curriculum. By contrast, other competency-based programs teaching lower-level occupations, in the view of many post-secondary experts, go contrary to the spirit of higher education--the integration of knowledge--since they rely on "mastery learning" techniques more appropriate to other levels of instruction. The third type of programs, aiming to develop competency materials for more complex professional occupations, are and will continue

to be mired in controversies about the skills and knowledge to be tested.

The potential employers of persons certified, who attained a given competency, do not have an economic incentive to encourage anything but the development of general skills, lest the pool of applicants for jobs be restricted. Specific skills are certainly more easily imparted on-the-job, and probably cannot be taught effectively in academic settings. Our economic analysis of the scope of competency-based tests or certificates concluded that, at best, they may be relevant to entry or near-entry jobs.

In the foreseeable future--a future characterized by an excess of college graduates--competency-based curricula and testing are likely to have a minimum impact. At best, they may prevent some marginal participants from being certified, and help some outstanding persons with exceptional experience to earn degrees with less effort.

Given the present state of the art and the current temper of the courts, vide the Duke Power Company case, the prospects of developing widely accepted competency-based tests are poor. This is not the time for large-scale federal action in this field.

Policy implications of human capital findings. In all probability the rates of return to college education are not as high as was first believed. Most likely they are going to be even lower in the future. Thus, instead of worrying about sub-optimal rates of investment in education, the policy analyst may wish to hone a public policy suitable for a period when there will be surpluses of college graduates for suitable jobs.

What are the implications and consequences of such a surplus? In the first place, if the rates of return to college education are well below those which are earned on physical capital, it is worthwhile to rethink the human investment theory postulates. Is it reasonable to say that part of the expenditure on education is consumption, and part is investment? If we agree with this proposition, the subsidy to the consumption part should be guided by the same principles as those which govern subsidies to other consumer goods. If we have food stamps for certain portions of the population, should we not champion education stamps (they are already known as the basic opportunity programs)?

Lower rates of return are also likely to restrict the attractiveness of different loan programs. With a seven per cent rate of return on educational investment (a generous estimate of the future marginal post-tax return if the trends calculated by Freeman are correct), an individual forced to pay seven per cent on his education loan, and also repay the loan over a limited time period, may have less disposable income than one who did not attend college. Is this a desirable outcome? How will it affect incentives for the gifted?

Without giving definite answers to these questions, it is obvious that the role which loans are likely to play in the future will be more restricted than that in the past (unless high rates of inflation lighten the repayment burden). The policy analyst, who is interested in maximizing the usage of loans, may also wish to recommend longer repayment periods in

order to lighten the burden on recent, low paid college graduates.

The uncertainty about future earnings levels of college graduates also puts a considerable strain on advocates of contingent income loan repayment schemes. In order to be self-sufficient, the repayment rates will, probably, have to be set much higher than originally anticipated. The potential liability, for public authorities, by entering into contracts with set rates deserves attention.

Perverse reactions to surpluses of college graduates. The clearest consequence of the difficulties encountered by college graduates in landing suitable jobs may be the encouragement of some, and there are indications that this proportion is increasing, to seek further education beyond the college degree. Studies of returns to graduate education indicate that until late '60's the monetary returns there were extremely low, on the order of four per cent. Thus, it could be inferred that many persons pushing their studies beyond the Bachelor's level expected to get additional psychic (or consumption) satisfaction from their jobs. Current graduate students, who may just improve their chances to the point of being assured a port-of-entry job equal to that of a four-year college graduate in the past, may thus be overinvesting in education.

The rational reaction to overinvestment in education is to attempt to cut the expense of acquiring the credentials. The most obvious way is to reduce the cost of instruction. Suggestions have been made about the granting of college credit for experience, etc. This will work if the

period spent in school is reduced, since the major costs of human investment in education are foregone earnings.

If we understood more fully what it is that happens during the time an individual is pursuing a degree, we could be more specific about the desired changes: reducing the costs of instruction, reducing the time needed to graduate, etc. We do not know enough to do so. Education is a black box, which, in the aggregate, confers attributes and benefits to those who own it. Furthermore, recent studies have shown that those who benefited from higher expenditures during their study period were given a bigger black box, which in turn conferred upon the higher benefits. Perhaps, we should gain some perspective about the operation of our economy: we did achieve relatively high standards of living and satisfactory rates of productivity with the old system. The danger of killing the goose which laid the golden egg is still with us.

Equalizing incomes. The expectation that increased educational attainment of the population was likely to result in the narrowing of income differentials has not materialized in the course of the past two decades. These expectations arose from an incomplete understanding of the effects of education on income. More sophisticated analysis indicates that (1) during a period when the number of young earners increases, the inequality of income may increase, even if overall equality increases, (2) those with more education continued to have higher increases in earnings than those with less as they grew older and, as other statistics tend to confirm,

continued to invest in their skills at a higher rate than those with less education.

It is quite possible that in the future, if the rates of return to incremental investments in education decline, and the variability between persons declines as well (possibly because a larger proportion of the educated will work for public authorities or because of administrative fiat brought about by wage controls) that income differences will be reduced. The role of education of reducing the income differences should not be overestimated, since even the most sophisticated constructs to measure returns to education explain less than half of the income differences. Ability, astuteness in choosing a profession, and just plain luck are likely to play a large part in determining future earnings of individuals.

Possible contribution of analysis. The most useful contribution of analysts may be careful projections of future rates of return for additional education. If these rates are disseminated to potential college entrants, they can make their decisions to acquire additional education on a more rational basis.

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PRODUCTIVITY AND SCREENING EFFECTS IN EDUCATION

Until now, the economic analysis of education has not contributed effectively to policy formation because it has failed to throw much light on two most crucial topics: (1) the question of who benefits from education, and (2) the concomitant question of the best way to finance education, particularly post-secondary education. The reasons for this failure have been the lack of consensus among economists about the effects of educational attainment upon the productivity of the economy, and the even wider disagreement about the distribution of benefits from additional schooling.

The present paper reviews the recent discussion on these subjects, and tries to tease out the policy implications of the more reasonable constructs of economic theory. It is divided into three parts: (1) a summary of the discussion of the effects of educational attainment on productivity in the light of recent controversies surrounding the aggregate production function, (2) an analysis of the recent writings on the benefits (rates of return) of educational investment and the manner in which these benefits are distributed, and (3) an analysis of the implications of these two topics upon federal policy for education.

EDUCATION AND THE PRODUCTIVITY OF THE ECONOMY

In the 1950's, economists began to question the ability of the conventional aggregate production function to provide accurate predictive results of the output of the economy. Conventional calculations were found to consistently understate the total output of developed economies, and three separate revisionist movements began to develop hypotheses to explain this state of events. The Cambridge (U.K.) school was the most radical; it questioned the relevance of production functions in economic theory. The Cambridge (U.S.) school proposed to salvage the concept by introducing a technological component into the aggregate production function. And the Chicago school (with a strong Eastern extension at Columbia and the National Bureau of Economic Research) proposed that labor inputs be disaggregated into two parts: labor itself, and investment in the education and training of labor.

The arguments of all three schools are summarized briefly below. The acceptance of one theoretical construct in preference to another has important implications for educational policy. Both the local and overseas Cambridge schools of thought would deny a major role to education in contributing to the productivity of the economy. On the other hand, the Chicago school would ascribe an important part of the increases in productivity to education.

The most fundamental attack on the concept of the aggregate production function (and, by implication, on the ability of economists to make

pronouncements about the effects of changes in the quantity of an input factor on total production) was launched by Professor Joan Robinson in Cambridge, U.K., in 1953. Robinson argued that

> The capital in existence at any moment may be treated simply as "part of the environment in which labor works." We then have a production function in terms of labour alone. This is the right procedure for the short period... but outside the short period this is a very weak line to take... (O)utside of the strict bounds of the short period, for any change in the ratio of capital to labour involves a re-organisation of the methods of production and requires a change in the shapes, sizes and specifications of many or all the goods...in the original list...

In other words, Robinson claims that capital cannot be measured significantly in the long run, and implies that neither can the contribution of labor. She further argues that capital cannot be meaningfully priced to explain the distribution of shares between labor and capital.

> We can value the capital good as a discounted stream of future profit which it will earn. But to do so we have to begin by taking the rate of interest as given, whereas the main purpose of the production function is to show how wages and the rate of interest...are determined by technical conditions and the factor ratio. Are we then to value capital goods by their cost of production? Clearly money cost of production (requires that) we specify the purchasing power of money... To treat capital as a quantity of labour time expended in the past is congenial... But a unit of labour is never expended in pure form. The cost of capital includes the cost of capital goods... Finally, even if it were possible to measure capital simply in terms of labour time, we still should not have answered the question: of what units is C composed? (Robinson, 1953, pp. 81-82)

Robinson's concern about the impossibility of measuring capital stock not only questioned the usefulness of the production function,

but also gave rise to a new controversy. Sraffa in 1960 questioned the possibility of measuring the marginal productivities of factors of production when more than two production equilibria could be achieved at a given wage and interest rate. If such a possibility existed, factors could be "reswitched" (for a summary, see Harcourt, 1969, 1972). If Sraffa's and Robinson's argument is accepted, the ability of economics to contribute guidance about the optimal allocation of resources is considerably weakened.

In the United States, the Robinson/Sraffa position has not been received with much sympathy. Samuelson (1966) has argued that the Robinson/Sraffa propositions could hold water on an industry-by-industry level, but would not apply to the entire economy. The argument rages on. (See Blaug, 1974.)

While the Cambridge (U.K.) school was attacking the usefulness of the production function concept, in Cambridge, Mass., attempts were being made to rehabilitate the predictive ability of this economic tool. Thus, Solow introduced the concept of technological change into the production function, and proposed a methodology for varying the productivity of capital between time periods (Solow, 1957). As Arrow stated in 1962,

> It is by now incontrovertible that increases in per capita income cannot be explained simply by increases in the capital-labor ratio. Though doubtless no economist would

> ever have denied the role of technological change in economic growth, its overwhelming importance relative to capital formation has perhaps only been fully realized in the important study...of Solow (1957). (Arrow, 1962)

Despite Arrow's evident admiration for Solow's work, his own conceptualization of technological change differs from that of Solow. He proposes a model where "learning by doing," i.e. experience, plays a major role in determining the productivity of capital, and consequently causes a divergence between social and private returns on physical capital. Arrow's model explains part of increased productivity by more efficient though not necessarily better educated labor.

The reasons adduced by both Solow and Arrow for rising productivity of factors of production are quite different from those championed by the human capital approach, which received its theoretical underpinnings from the work of Schultz (1960, 1961) and Becker (1962, 1964). The theory of human capital which Schultz and Becker presented assumes the measurability of capital in general, of human capital and of returns thereto. In other words, they proposed that the labor component of the production function should be separated into two segments, labor itself, and the investment in education and training of workers.

The application of their ideas to production functions was pioneered by Denison (1962), who ascribed roughly one-quarter of the increase in the productivity of the U.S. economy between 1929 and 1957 to increases in the educational stock. This figure has been widely quoted, despite the fact that the method used to derive it has not been universally

understood. Denison's analysis is firmly anchored in the assumption that the marginal productivity of factors of production was equal to their price (a common assumption of aggregate production function theorists and practitioners using this particular way of modeling the economy). This is not the major weakness of his analysis. In our opinion, the allocation of the contribution of education, knowledge, etc., to the residual productivity growth is unconvincing, since there is a great deal of multicollinearity between these factors and, in the final analysis, the allocations are made on a judgemental level.

Denison is aware of these shortcomings of his method, but has defended it consistently, because he feels that a direct method of estimating the effects of either knowledge or education is not feasible (Denison, 1974). Despite some attempts to improve the methodology of estimating the effect of education and knowledge on production in his later work, John W. Kendrick in reviewing his latest work was not fully convinced by the improved methodology:

> Most reviewers of Denison's prior works have stressed the fact that many of his estimates of his growth components have a slender factual base. Despite the improvements in this volume, there are still uncomfortably large margins of possible error in some of these estimates... Although his estimates of the productivity effects of rising educational levels and relative shifts of workers out of farming and self-employment have far better statistical underpinnings, even these assume constant proportionate income differentials throughout the period, based on data for one year. (Kendrick, 1975, p. 910)

An important claim made by Denison was that the benefits of an increased stock of education were distributed not only to those with more education, but also to that segment of workers whose educational

level did not increase. This was a very attractive finding, since the general population does subsidize some education for the minority. Unfortunately, even this finding has been questioned as a by-product of an analysis by Jorgenson and Griliches in a paper which attempted to explain total factor productivity. These two authors postulated that "if quantities of output and input are measured accurately, growth in total output is largely explained by growth in total input... (Or) if real product and real factor input are accurately accounted for, the observed growth in total factor productivity is negligible." (Jorgenson and Griliches, 1967, p. 249) They conclude that their hypothesis is supported by the experience of the United States in the period 1948-1965, and that their results are contrary to the conclusions drawn by Solow, Denison and Arrow (ibid, p. 272). It is significant that in their calculation, Jorgenson and Griliches differentiate labor inputs by level of education. Their assertion that their formulation is "just the reverse" of previous authors need not be accepted to integrate their argument into the main body of theory. According to Denison (1966), Jorgenson and Griliches' estimates are suspect, since the assumption about the equal intensity of utilization of all capital goods is crucial to their findings. This assumption is no more devastating than the assumption of perfect competition underlying Denison's estimates. Thus, if the Jorgenson and Griliches results are plausible, the spill-overs of educational benefits cannot be taken seriously.

After nearly two decades of furious and, occasionally,

intemperate debate about the meaning of production functions, it appears reasonable to believe that increasing levels of education, up to a certain point, are probably necessary but not sufficient conditions for economic growth (Blaug, 1972). There is also little doubt that the minimum levels needed to perform existing jobs have been reached or exceeded in the United States (Jaffe and Froomkin, 1968).

Even some of the more enthusiastic proponents of education as a factor in economic growth are likely to agree that this is the case. Later work by Denison (1967), which uses similar techniques as his previous study, shows that in a variety of European countries which achieved spectacular rates of growth, there was little occasion to explain growth by the stock of education. Also, while still defending the proposition that higher levels of education are likely to help productivity, since better educated persons accept technological innovation more rapidly, in his latest writing Schultz seeks to justify the accumulation of "educational capital" on the basis of other benefits to those with more schooling (Schultz, 1975). Schultz argues that the better educated spend their money more wisely, and also take better care of their health. These subjective evaluations are difficult to quantify, and probably impossible to aggregate for the economy as a whole.

The possibility of explaining the contribution of various factors to the productivity of educated personnel is only limited by the availability of data and the ingenuity of researchers. Welch (1970), for

instance, explains the productivity of "more relative to less schooled persons" in agriculture by taking into account non-labor inputs, research expenditures, and days per farm by extension personnel. The much higher explanatory powers of his equations augur well for this type of analysis.

In conclusion, it would appear that economics is unlikely to provide an exact estimate of the contribution of education to productivity from conventional data, and that the hopes of justifying subsidies to education must be based on micro-data.

THE HUMAN CAPITAL APPROACH

An alternative approach to the evaluation of the worth of additional education received its impetus from Milton Friedman's concern that investment in human capital, i.e., additional education, might be kept down to sub-optimal levels because (1) individuals, as compared to businesses, had less access to capital if they wished to borrow to finance their training and (2) the risks of investing in oneself were greater than those of investing in stocks and bonds, since the risks could not be shared nor the investment dispersed. In order to test this hypothesis, Gary S. Becker, a student of Friedman, undertook to calculate the rate of return to education (Becker, 1964).

The theoretical contribution of Becker in defining the rate of return of education started a real industry, or branch of economics. Individual rates of return are calculated by deriving the discount rate which equates the present values of the increment of income of persons with more education and the additional expenditures which they incurred to attain this level. The expenditures include tuition, fees, books and foregone (unearned) incomes during the period of education or training. In early studies, only cross-sectional data on earnings profiles of persons with a given level of education was available. In other words, the incomes of, say, college graduates at different ages in a given year, are assumed to be representative of the income prospects of persons with this level of education over their lifetime. The most recently

published estimates of the returns of different levels of education for the period 1939-69 are reproduced in Table 1 (Carnoy and Marenbach, 1975).

These rates, unadjusted for differences in ability, show that for all groups, with the exception of black females, the returns on investment decline with every increment in education. More significantly, it would appear that the levels of returns to education for both high school and college graduates for white males declined over the period 1939-69. Only in the case of white and black females do returns seem to increase, and in both cases the apparent increase is due to higher labor participation rates of women in the later time periods.

Another set of estimates of social rates of return is also presented in this article. The social rates of return differ from individual rates of return, inasmuch as in this particular calculation the costs are increased by including the public subsidies to each level of education, and by reducing the stream of earnings by the mortality in each cohort. These figures are reproduced in Table 2.[1]

The rates of returns estimated from "cohort" data constructed by

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[1] There are many alternative ways of calculating social returns. Some of them will be discussed later in connection with screening effects of education. A number of economists believe that an additional reduction in earnings of the more highly educated workers must be made to account for the advantages which these workers have in obtaining "good" jobs, an ability not entirely related to their training.

building up earning profiles from data in successive censuses (incomes for persons with a certain level of educational attainment by interpolating data for various years as explained in Table 3) indicate that the social rates of return are somewhat higher using this technique. The increase in the productivity of the economy over time causes this to occur for white males. In the case of black high school graduate cohort of 1939, the higher increase in rates of return is due to migration of black high school graduates from the South and their employment in higher-paying industries.

Another recent study of the returns to education, using a somewhat different data base, the experienced labor force earnings reported in the U. S. Bureau of the Census, estimates the private returns from college education at roughly 10.5 to 11.0 per cent for the period 1959 to 1972 and the social rate (calculated roughly the same way as in previously cited estimates) at between one-half and one per cent less. The author of these estimates, R. B. Freeman (1975), has tentatively estimated the return from education to a later cohort of college graduates, for 1974, at the low figure of 8.5 per cent. (See Table 3.)

The difference in the estimated rates of return to education in two studies by Carnoy & Marenbach and Freeman published in the same issue of a journal provides a propitious opportunity to discuss some of the assumptions which underlie these calculations. As a general rule, the average expenditures for tuition, fees, and books are added together with seventy-five per cent of the earnings of high school graduates in order to calculate the private costs. An assumption is made that, on the average, students earn twenty-five

per cent of the wages of full-time employees with less education. This is already a rough approximation of the opportunity costs of students. The estimated average expenditures on tuition and books are an educated guess taken from data collected by government agencies and organizations which have been concerned with student financial aid. The problems of making these estimates are dwarfed by the issue of calculating foregone earnings. There are two schools of thought on this subject. Some non-economists and a few economists have questioned the relevance of foregone earnings, either by arguing that some consumption benefits were derived by students by attending post-secondary institutions, or that students in college could achieve an acceptable life-style at a lower cost than persons without access to the social facilities of a college. It has also been suggested that economies of scale in feeding and housing should be taken into account in calculating the real level of foregone earnings. By contrast, a recent article has made the case that foregone earnings are understated, inasmuch as students spend more time studying and working than the average high school graduate spends working. Hence, the foregone cost of leisure time should be added to the amount of foregone earnings. Unless one is convinced that the money utility of leisure time is equal to that of time spent on the job, there are difficulties with this concept of calculating "real foregone earnings." (Parsons, 1974)

Equally serious problems surround the estimates of income differentials between college and high school students. The most important

question relates to the calculation of average earnings of both groups. Should differential rates of unemployment be considered when comparing the earnings of college graduates and students? Should allowances be made for differential rates of participation in the labor force? Should the differences be calculated for full-time, full-year workers, and if so, should some allowance be made for the number of hours worked per week? On theoretical grounds a good argument can be made for taking all these factors into consideration in calculating rates of return. Unfortunately, the best intentions of researchers are often defeated by the content or the quality of the statistics that have been collected. At best, then, the rates of return which are calculated must be considered as approximations.

The search for better data bases has led to the reconstruction of the earnings records of a group of potential pilots and navigators who had taken an ability test during World War II. This data set enabled researchers to study the effects of ability, as well as education, upon future earnings. According to Taubman and Wales (1972, 1974) who analyzed this data, the data base is representative of the upper half of the ability distribution of high school graduates. Information about the educational attainment and earnings of this group was obtained through two waves of follow-ups.

The analysis by Taubman and Wales has two advantages: It relies on longitudinal data, and it also standardizes returns on investment

for differences in ability between high school and college graduates. It is thus significant that after standardizing for ability, they estimate the rate of return to college graduates to be 11 per cent. Less convincing is their estimate of the return from a partial college education, 15 per cent. This later finding is not supported by other calculations and, as the authors point out, is probably due to the atypical nature of college dropouts in their sample, which is more heavily weighed with self-employed persons who did not complete college compared to a national cross-section of college dropouts. The social rates of return calculated by Taubman and Wales are much lower than those usually cited by other researchers. They are 11 per cent for persons with a partial college education, and 8 per cent for college graduates. The two authors depress their estimate of social return not only by including the cost of public subsidies, but also by introducing an adjustment for the screening effects of education which, according to them, allow college graduates to fill better paying positions. This argument will be examined in greater detail below (see Table 4).

Economists would interpret positive rates of return to education as an incentive to participate in additional schooling. The higher the individual rate of return from additional education, the higher the proportion of eligible persons likely to choose to continue in school. Unfortunately, this is a rather simplistic analysis of the decision to continue one's education. It assumes that too many things are equal. The decision

to continue "investing" in one's human capital certainly depends not only upon the rate of return, but also on the general well-being of the population, i.e., the ability of parents to enjoy a desirable standard of living without their children's contribution to the family income and, perhaps, the parents' ability to contribute to the upkeep of their children beyond the compulsory age of attendance. Also, if the availability of scholarship or loan funds reduce the risk of non-completion of one's education, the expected rate of return needed to attract a certain proportion of the population to college may be lower than when no funds for scholarships are available (Froomkin, 1969).

EDUCATION AND EARNINGS LEVELS

Human capital theory postulates that persons with different levels of investment in education, the most common part of human capital, will have earnings levels proportional to their investment. This is the simplest, though not necessarily the correct, statement of the human capital approach. The complete statement of human capital theory recognizes that ability, experience (measured in terms of number of years of experience in the labor force) and, perhaps, connections and luck can also affect earnings.

A policy analyst is thus interested in the role of education in determining earnings in two different contexts: (1) to what extent selective incentives to investment in human capital are likely to equalize its distribution either over the life of an individual or at some given time, and consequently reduce income disparities, and (2) how investment in human capital contributes to social and economic mobility or, in other words, to what extent can the children of the poor have a hope of bettering themselves by persevering in school or enrolling in other types of training.

These concerns are not kept apart in some analyses of the effects of education. Thus Jencks et al. (1972) do not distinguish between these two policy objectives. Their rather narrowly-based study, which attempts to measure the effect of education on inequality of incomes at one point in time, comes to the unsurprising conclusion that statistically educational attainment explains a small part of the variation in absolute levels in earnings.

Most economists have made short shrift of this study for good reasons: (1) their explanatory equations are mis-specified, i.e., incorrect, since they try to explain the level of variance of incomes, not wages, rather than the relative differences between the wages of persons with different levels of education, (2) their equations understate the effect of age, and thus fail to take into account the impact of experience on wages, an omission which makes the results meaningless for persons with post-secondary education, whose distribution by age is different from the bulk of the population, and (3) their independent variable is income, rather than earnings, thus considerably weakening the possible strength of the correlation analysis.

More sophisticated analyses of the effect of education on earnings have ascribed a much higher role to education in explaining earnings differentials. In a recent review of the evidence, Hill (1974) has summarized the analysis by economists as follows:

> Jacob Mincer's recent monograph, Schooling, Experience and Earnings (1974) has as its objective, "...an understanding of the observed distribution and structures of earnings from information on the distribution of accumulated net investments in human capital among workers." The investments in human capital studied take two complementary forms: formal schooling measured by years of school completed, and work experience measured by potential years in the labor force subsequent to the completion of schooling.
>
> The usefulness of the theory of investments in human capital developed by Mincer lies in the extent to which it provides a unified interpretation of detailed empirical characteristics of earnings distributions. Mincer's work

> makes clear, for example, the importance of controlling for years of work experience in analyzing the effects of schooling on earnings inequality. Indeed, the impact of schooling on earnings is most apparent in what Mincer calls the "overtaking" subset of earnings distributions. The overtaking year of work experience is that time at which the earnings of continuing investors in human capital are equal to the earnings of those with equal schooling who did not continue to invest. This overtaking point, Mincer estimates, occurs within 7 to 10 years after the completion of school. As measured by percent of variation of earnings explained, the effects of schooling on earnings decay continuously after this first decade of experience. This reflects the growing importance of accumulated on-the-job experience in the determination of earnings and makes clear the misspecification of an earnings regression which, like Jencks', does not control for work experience. Within this overtaking subset of the earnings distribution, Mincer's simple model explains a third of the earnings inequality of white males in contrast to the 7 percent explained when the simple model is employed for the aggregate distribution. When the aggregate distribution is studied, variables representing work experience must be explicitly controlled for in the earnings regression. When this is done, schooling and post-school investment alone accounted for an extraordinary 60 percent of the variance in earnings of adult, white, urban men using data collected from the 1960 Census. Using Jencks' own criteria of importance, Mincer's work points to a much more "important" role for schooling in explaining earnings inequality.

It should be noted that the strength of the human capital approach is much more in evidence in explaining differences in group means of incomes than in explaining individual earning differences. Other studies, summarized in Table 5, have also been successful in explaining a large part of the income differences, usually by using group means. As long as the variability of incomes among persons with the same amount of education remains high, the possibility remains that the model is not fully

specified.

A side-issue, which has been increasingly discussed lately, is that, until very recently, income differentials between those with a great deal and those with little education failed to narrow as the proportion of highly educated people increased. The three explanations which are usually offered (Okner and Rivlin, 1975) are (1) that technology changed and the demand for employees with education grew at the same rate as supply, (2) that workers queue up for jobs, and those with the most education go to the head of the line, continuously skimming the cream off the labor market, and (3) that new, not necessarily rational, requirements are set by employers as the average education of workers rises. This is another form of the screening argument.

As an aside, we should note that Thurow and Lucas (Thurow and Lucas, 1972 and Thurow, 1975) believe that their queuing model is not compatible with the human investment approach. In his later work, Thurow takes great pain to attack the marginal productivity of labor in order to make this point. By contrast, if one does believe that the marginal productivity of labor is important in wage determination, the queuing theory is compatible with the human investment approach: workers queue for jobs, and the best jobs go to those with more education and training, since they are more productive. This proposition has not been proved convincingly.

An exposition from the radical point of view of this lack of

convergence of incomes has been mounted by Bowles and Gintis (Bowles, 1972, 1973, and Bowles & Gintis, 1975). Bowles has argued that social class plays an important part in explaining income differentials, more so than educational attainment. Part of his argument, as Becker (1972) has pointed out, is not incompatible with the human investment approach, which ideally would take into consideration investment by parents, the amount spent by educational institutions, etc. From a policy standpoint this is a non-trivial issue, since income equalization under these assumptions would require considerable augmentation of investment for the education of the children of the poor in order to achieve income parity.

Radical critics do not share this urgency. They argue that childhood socialization is conditioned by the class structure of the capitalist society and makes the haves more efficient trainers of successful offsprings (Bowles, 1973). It is the nature of capitalist society which determines the definition of success. The human investment model of income distribution, which concentrates on the demand for labor without understanding the conditions which govern its demand, is thus irrelevant (Bowles & Gintis, 1975). This argument attacks the very core of economics as a normative science. Its proponents, working in the Marxist tradition, have been unable to offer convincing alternative explanations to the workings of the market for educated workers.

THE EXPLANATION OF INCOME DIFFERENCES

The increasingly sophisticated regression analyses used to explain the relationship between investments in human capital and earnings do not prove that a causal chain between investment and earnings has been established. It is quite possible that some essential element in the chain has been omitted and that the missing variable is strongly correlated with one of the measures included in the regressions. The model tested may be based on unreasonable assumptions, and hence produce unacceptable explanations of the relationship between the independent and dependent variables. The acceptance of a model for policy-making depends upon a subjective decision by the analyst that the model does describe reality, and is statistically significant.

It is significant that human investment models have been challenged by a number of observers of the labor market scene, and a policy analyst should be aware of these criticisms. Two of these critiques, one implying that employers discriminate on the basis of educational attainment in assigning persons to jobs, and the other that employers use educational attainment to screen employees for certain jobs, deserve attention.

Discrimination on the basis of educational attainment. The possibility that employers discriminate on the basis of educational attainment to assign better-educated workers to better jobs was raised by Eckaus (1964), who noticed that the median educational attainment of workers in the U.S., occ pation by occupation, was rising from one decade to the next. He compared the actual educational attainment of workers by occupation with

the minimum requirements for educational attainment listed in the U. S. Department of Labor, Occupational Outlook Handbook, and came to the conclusion that most workers were overeducated. Other studies have shown that the education necessary to perform a variety of blue and low-level white collar jobs was greatly overestimated by workers, somewhat overestimated by employers, and set at a much lower level by job-classification specialists. (Jaffe & Froomkin, 1968)

Possible succor to those who may wish to argue that management is irrational comes from a survey of the operation of 68 plants employing 26,000 workers in the electrical engineering industry in the United Kingdom. Plants with more educated workers, the researchers found, did not have a higher profit rate, higher sales per unit of capital, faster rates of growth in sales, higher output per worker, or lower unit costs (Layard et al, 1971). The results of this study can either be taken as proving the irrationality of employers, or used to illustrate the difficulty of doing empirical work in the field. For instance, Blaug (1972) mentioned four possible reasons why the results of the study did not prove the irrationality of employers: (1) the plants examined were not on the same production function. This hypothesis is reinforced by the finding that the statistically significant regressions in the study were between level of education and product mix, (2) the product mix of either labor or capital, or both, in the plant was not at the optimal mix, having failed to adjust to recent changes in factor prices, (3) factors important

to the economic performance of the plants, be it management policy, research and development, etc., were omitted from the regressions, and (4) the contribution of the more educated workers was exactly off-set by their higher wages.

Two members of the Columbia University Human Resources project, Berg (1971) and Freedman (1969) have cast further doubts upon the relevance of education for the majority of jobs. Attempting to replicate the Eckaus study, Berg tries to improve on the previous effort and produces five estimates of the balance between supply and demand. He concludes:

> The problems in estimating the nature of the utilization of educated manpower in the United States by the "direct" approach are, at the very least, a good deal more complex than might be supposed from a reading of the earlier and ground-breaking studies, even allowing for their cautious stipulations concerning the adequacy of the data. (Berg, p. 59)

Despite these reservations, Berg attempts to draw a balance between the economy's requirements for educated manpower and the likely supply, and views with alarm the potential over-supply. However, his methodology can be faulted, as can all methodologies which are based on the analysis of broad occupational descriptions, for he does not distinguish between jobs with similar titles in different industries.

Berg's other contribution is an examination of studies of the performance of workers with different levels of educational attainment. He concludes that workers with more education are not more productive,

more satisfied with their jobs, or more loyal than less-well-educated workers in similar jobs. These studies and his own attempts to analyze hiring practices in a number of large companies lead him to the conclusion that employers are irrational in setting high educational requirements.

In a study examining "work establishment" (i.e., the search for a first job and subsequent experience) an associate of Berg, Freedman, finds that the process is so complex as to be practically indescribable (Freedman, 1969, p. 112). Thus education and training, Freedman finds, play only a minor part in this process. Subsequent promotions, she asserts, are related to length of service and other organizational factors rather than education and training (Ibid, pp. 11 and 82).

The negative results of the case studies tend to be shrugged off by economists, possibly for good reasons. The studies do not aspire to describe the work environment in rigorous terms, and do not tell us whether the working conditions are any different in locations where workers have lower levels of education or training than in locations where the workers are better educated or more highly trained.

Either employers do not take the opportunity to lower costs by employing less educated, and supposedly cheaper workers, or the competitive system is less effective than has been postulated, or one has to fall back on two hypotheses such as the following to explain the state of the labor market described by Berg and Freedman: (1) employers, not only in the U.S., but world-wide, are subject to mass delusions which makes

the experience in Salem, Mass., look like a trivial aberration, or (2) the description in the case studies is incomplete. The economic scene is rational and guided by the invisible hand which Adam Smith described so eloquently. Sociologists and institutional economists can neither recognize nor describe this state of events.

The screening or external-test hypothesis. A different line of questioning of the value of higher educational attainment, this one consistent with rationality on the part of employers, has gone under the umbrella title of the "screening" hypothesis. The hypothesis states that educational attainment is used to choose persons for port-of-entry jobs and, possibly, subsequent promotions. Persons with more schooling get better-paying positions to start with, positions with the best promotion opportunities.

Peter Wiles (1974) has argued that employers could be acting rationally by accepting formal educational qualifications as "accurate proxies for employability." If educational qualifications are certificates of "ability, perseverance, or docility," the degrees are useful tags to identify good workers.

Wiles suggests that if the "content, rather than screening effect," were important, it would be possible to test the hypothesis by examining the correlation between the relevance of the subject matter and the quality of the academic achievement. A high correlation with the first variable would, according to Wiles, buttress the human capital

approach, the second the screening approach.

The results of this test may not be conclusive and Wiles suggests that a more complex view of the effect of education be adopted. It can be just as plausibly argued that character formation (those desirable virtues of maturity, docility, persistence and self-confidence imparted by education) is more important than content. Or, perhaps, if "sheer schooling...develops general intelligence, just as sheer repetitive unskilled juvenile labor dulls it," the "exercise-not-content" hypothesis could be adopted.

Even more tantalizing, though difficult to prove, is the "status-not-content" hypothesis, which Wiles argues confers a leadership mantle on the more educated, and it is logical to seek degrees both for monetary and social profit.

Finally, Wiles mentions that restrictive practices may confer a value to a degree. The restrictive entry requirements imposed by medical doctors, for instance, and the arguments by some public servants, such as teachers, that additional education of their members confers social benefits to the public, serve to reduce the supply of qualified personnel and enable certain professionals to charge more for their services. The above proposition, Wiles claims, is proved by the higher educational qualifications demanded by public employers whenever they compete with private industry for the same type of workers. This hypothesis could be tested by company occupational distribution by industry from the U. S.

Census, but, to the best of our knowledge, has not been by any researcher

The arguments adduced by Wiles are meant "to rescue the economics of education from Chicago: from the presumption of rationality and perfect competition, nay even of social justice in a market." Wiles concludes, "There is nothing wrong with applying economic analysis to education; but there is much wrong with a particular sort of naiveté."

Taubman and Wales (1973, 1974) attempted to measure screening effects by postulating that persons with less education were unexplainat underrepresented in certain desirable jobs. They calculated the wages which would accrue to high school graduates, college dropouts, and college graduates if these three groups were distributed randomly in occupations where persons with their educational attainment already held jobs. On the basis of this revised distribution of occupations by education, the two authors concluded that roughly 20 per cent of the private returns to college education were due to the use of education as a screening device, and should not be included in social rates of return.

The broad challenge to the economic profession in Wiles' article is just beginning to be discussed by economists. A recent article by Layard and Psacharopoulos (1974), for instance, attempts to examine the screening argument. The authors are successful in pointing out the weakness of the screening test used by Taubman and Wales. They argue that Taubman and Wales assume that employers are not allowed to discriminate between highly motivated persons with

less education, as contrasted to the less motivated ones with similar credentials.

The main body of Layard and Psacharopoulos' article, which purports to "demonstrate" that certain predictions of the screening hypothesis are not verified, is less successful. The first hypothesis which they try to demolish is that private returns are to certificates and not to years of schooling. Reviewing a number of studies, they indicate that both Taubman and Wales (1974) and Rogers (1969) show higher rates of return for dropouts of a program than for completers. This is a lame proof. The Taubman and Wales college dropout sample was atypical of college dropouts, since self-employed individuals were over-represented. The Rogers sample of eighth graders in Connecticut schools in 1935 has a number of strange characteristics which make one suspicious of it (for a critique, see Taubman and Wales, 1973). In all other cases, the returns for dropouts were somewhat lower than for graduates. In any event, the argument is not conclusive, since the screening hypothesis would still hold if persons with some education, such as a few years of college, benefited from some screening.

The two authors then discuss a second hypothesis ascribed to screening proponents, that private returns to education decrease with work experience. They point out that the differential in earnings between persons with less and more education increases with age. Employers

who can judge the proficiency of their workers would be acting irrationally if they raised the wages of the more educated workers faster than those of more efficient, but less educated workers. Again, and in this case the admission comes from the authors, this does not disprove screening. If it were true that "people with credentials are selected for escalators that rise rapidly and others for ones that move more slowly," the earnings differentials would widen. Despite their argument, based on Layard's and associates' studies showing that the distinctions between education and occupation are not as rigid as most theorists indicate, the hypothesis is neither proved nor disproved.

Layard and Psacharopoulos recognize that pro-screeners can be helped by the theory propounded by Mincer (1962, 1974) that a greater proportion of the earnings differences are likely to be ascribed to on-the-job training and education, rather than to education alone. If persons with more education benefit more from on-the-job training because of employers' subjective preferences, the "anti-screeners'" hypothesis is greatly weakened. They maintain that "there is no conclusive answer to this argument," but they would like to lay the burden of proof on persons who attack the human capital approach.

The third argument which is examined by these two authors is that education will not be demanded if cheaper screening methods exist. They believe it would be unlikely for no cheap screening tests to have been devised if this argument were true. They pick a quarrel with Wiles,

who argued that there was little incentive to develop these tests as long as educational subsidies were not paid by employers, while the cost of testing would have to be. Wiles claimed that the cost of finding a suitable person with less education may be prohibitive to individual employers. Layard and Psacharopolous do not believe that our system would fail to develop these tests if they were appropriate. In fact, however, valid tests may be quite difficult to develop. It will be remembered that the measures of ability or propensity to succeed developed by American testing services, such as the College Entrance Examination Board, are not the best predictors of rates of graduation. Furthermore, it is quite likely that such tests would still give an edge to persons with more education. A society which has put a man on the moon may not be capable of developing tests which measure potential performance on earth.

A much more promising attack on the screening hypothesis is now being carried out by younger econometricians. For instance, Albrecht (1974) has examined the hiring process for low-level executive jobs at the IRS and has come to the tentative conclusion that the IRS did not use education as a screening device in the final stage of hiring. (Albrecht, 1974, p. 22) Nor did the same writer's analysis of hiring patterns from Project Talent follow-up data give any succor to screening advocates. Three tentative conclusions all contradict the hypothesis of the screening proponents:

> The tentative conclusion to be drawn from the Project Talent data is that organizational ossification suspected of causing credentialistic hiring practices cannot be captured by looking simply at size of an employer...
>
> (F)or nonprofessional job categories examined (the) educational attainment and employer are independent. In the professional categories there is not sufficient variation in educational attainment to test for independence. An examination for B.A. holders in those categories does, however, indicate an association between measures of college quality and employer as well as an association between college grades and employer. Private firms are more likely to employ workers in the professional categories who come from better colleges and receive better grades than government agencies.

These conclusions are extremely encouraging. The first examines the process of hiring and concludes that the educational screening does not hold. The second and third findings are equally damaging to the pro-screeners. The hypothesis that government recruits persons with higher educational credentials does not seem to be evident, for instance. The practice of business to hire graduates of the better schools, as well as students with higher grades, is again consistent with the human investment approach, which has postulated positive returns to ability and to school investment. For members of the Project Talent sample, these returns behave the way the human capital theorist says they ought to: the wages of professionals in the private sector are higher than those in the public sector.

An even more ambitious attempt to identify the influence of education, ability and performance in school, and the interaction of academic performance with personality factors was attempted by Wise (1975).

Based on a survey of 6800 employees of the Ford Motor Company, the study leads one to conclude that an important part in salary determination is academic achievement and aptitude. This conclusion is arrived after the effect of college majors and non-academic, i.e., personality and background, variables are controlled for. If "good" academic experience does contribute to success more than indifferent academic experience, there is additional reason to believe that academic preparation does play a real part in contributing to the productivity of persons with college education.

COMPETENCE-BASED TESTS AND THE LABOR MARKET

An evaluation of the possible effect of competence tests or competency-based programs on either screening or changing educational requirements will depend, as the discussion below will show, on (1) what is being tested, (2) how schools can adjust to the changes, and (3) whether a consensus can be developed to determine characteristics which predict performance.

At the most superficial level, a requirement for passing a competence-based test, as a condition for entry into or promotion within a given organization, is likely to increase competition for those jobs for which such a test is used. On condition that the test is offered to all comers, restrictions based on education, past experience, or other barriers are removed, and more persons will apply for these jobs. Hence the market for more desirable jobs will become more competitive because some persons customarily excluded from consideration because of artificial standards, such as the possession of a diploma or degree, presumably will be able to pass the test successfully.

Given keener competition, it would appear that the salaries for the most desirable jobs might go down. This would not necessarily happen, however, as a perfect competence test will help employers eliminate deadbeats. As a consequence, the marginal productivity of employees will go up and this, in turn, will increase the demand for "competence

tested" employees. With employers better able to evaluate the potential level of productivity of new employees, some wages may not go down as much as anticipated, and others actually increase. Thus, the efficiency of the labor market will improve, and the economy will become more productive.

The effects of the competence test upon the demand for education will depend upon the attributes which are deemed to be tested. Jobs that require general knowledge will probably require competence tests which will favor additional exposure to formal schooling. Since general knowledge can also be acquired through non-formal channels, it is likely that the competition for these jobs will be enhanced, and the returns to formal education reduced. In economic theory, lower returns to formal education ought to result in lower demand for schooling.

For jobs which require specific knowledge, much will depend upon the specificity of the required knowledge. If such knowledge pertains to an industry as a whole, it can probably be taught in school. In that instance, the introduction of a competence test will force students to concentrate on acquiring this type of knowledge. It might, therefore, induce a shift in demand for particular curricula, but would not necessarily affect the general demand for education. By contrast, specific knowledge which is developed purely in the context of a job in a given work location (such as knowledge about a given firm's policies or products, or ability to understand the rules and regulations of a given government department)

is not likely to be amenable to institutionalization for mass instruction in a school setting, and would therefore not influence the general demand for schooling.

It is quite likely that most competence tests for more advanced jobs in any given organization will favor those who are already members of its staff, and the impact of a competence test upon either widening the choice of candidates or eliminating screening effects will not be substantial. Only if the judgement of management is so poor that they are likely to make mistakes in promotion will competence tests either improve the operation of the labor market or increase the demand for in-service training.

As long as most employers, as a matter of policy, attempt to fill most higher level jobs from the pool of existing employees, the effects of competence tests would be confined chiefly to the lower level (i.e., near-entry) jobs, where specific knowledge is usually not expected. Individuals may not wish to risk failure on these "access" tests and may, therefore, decide to take more formal schooling than they otherwise would, in order to ensure success. In consequence, the introduction of competence tests may not discourage the demand for education.

The above discussion has assumed three unrealistic conditions: (1) that a unique standard can be established to determine competence for each job, (2) that an applicant can be graded simply on a pass or fail basis, and (3) that subject matter of the test is monolithic and is

limited to simple operations for which a single attribute is necessary. If these assumptions are relaxed, as they should be in discussing suitable competence tests for persons with some college and with college degrees, the impact of competence tests on the organization of the labor market becomes still more problematic.

Consider, for instance, a competence test with four parts, measuring four different attributes such as (1) attitude or personality, (2) ability or intelligence, (3) general knowledge, and (4) specific knowledge. The grade on such a test is difficult to interpret. An optimal choice among applicants is not clear when, for example, one has somewhat more than the minimum scores on all the attributes, a second also has scores moderately above the minimum but with a different profile than the first, and a third has high scores on some attributes and less than minimum scores on one or more others. To handle this type of problem, it must be assumed that jobs are sufficiently well defined so that trade-offs on different parts of the test can be quantified. But so long as professional and managerial jobs (positions filled by most college graduates) contain a great deal of variety, it is unlikely that one standard covering the vast variety of these positions and meeting the trade-off criterion can be established.

The impact of a multi-faceted test on the education likely to be demanded would depend upon both whether the attributes can be conferred by the educational system and (if they can) at what cost. In some

cases, as Wiles (1974) has argued, some attributes may very well be by-products of education. For instance, if a college or university instills the arrogance necessary for leadership, and if this quality is measured effectively and given the appropriate weight in a competence test for a job which requires leadership ability, the by-product may be as valuable as the knowledge imparted. Similarly, experience in test-taking, which extended education provides, counts for something in test-taking success. Counselling about tests which a person may pass with flying colors is perhaps also likely to be more effective in a milieu where contacts between teacher/observer and student/potential test-taker stretch over a prolonged period of time. Perhaps these ancillary advantages offered by educational institutions, as well as their comparative advantage in instilling general knowledge, will protect them from competition from new organizations which might spring up to teach the tests.

The future of education as we know it, if competence tests are developed, will depend heavily upon the attributes likely to be tested. If employers become convinced that most jobs are quite simple and that much of the complexity of professional and managerial jobs is a myth, then simple skills that can be taught in a short time, concurrently with test-taking techniques, will become more important and education may become oriented to teaching these skills.

If, on the other hand, our convictions about the complexity of professional jobs do not change, those attributes which can be taught

in a short time are likely to be stressed less than general knowledge. * If competence tests are most likely to be used for entry-level jobs, and if they seek to measure both general ability to perform a job and to progress in a given organization, the general and specific knowledge components will be emphasized more than those attributes which can be taught quickly. If it is accepted that general knowledge is hardest to impart, the present structural organization of post-secondary education will not change drastically absent a marked shift in beliefs about professional jobs. We believe that in the long run, in order not to reduce the pool of prospective qualified applicants, most organizations will emphasize general, rather than specific, knowledge tests.

Widespread acceptance of competence tests seems more likely to exert a marked influence on the organization of instructional processes than on content. The methods used to impart general knowledge, for instance, might respond to employers' de-emphasis on easily-trainable attributes. By some criteria, such changes would improve the quality of American education. At the same time, tending to make it more costly and, therefore, probably more exclusive. Probably, changes in the instructional process would result, over the long run, in changes in the structure of higher education.

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* If institutions succeed in teaching prospective test-takers how to earn high scores on some attributes, the tests are likely to be re-standardized to take account of this. Consequently, those attributes which can be taught quickly will receive even less emphasis than they did initially.

A competence test which focuses on general knowledge and de-emphasizes easily trainable skills (such as test-taking ability) would probably require test-takers to write essays, since attributes measured by such tests would require the applicant to have a good grasp of the fundamentals of written communication, including basic grammar and spelling as well as the ability to think logically and to present ideas in a well-organized sequence. An essay-like competence test would thus force schools to return to the standards of an earlier era, when linear, logical thinking and literacy skills were more highly valued than they are now.

Most employers know that degrees conferred by different colleges certify different levels of competence in subject knowledge and/or ability to communicate that knowledge. The use of a standard, national test would highlight differences, because institutions could be "graded" on how well they succeed in producing an acceptable product, i.e., a literate, logical, and well-socialized graduate. One result of such "grading" might be the introduction of a curriculum aimed at meeting the national norm in schools which have no special claim to fame. (This has already happened in law, where schools with little prestige teach to the bar exam and those with much prestige teach law.)

To sum up, the introduction of a standard competence test might serve to upgrade the average quality of education. It will not, we think, affect the attainment of the outstanding student but, as the example of the legal profession suggests, would be most likely to affect the

attainment of the marginal student. To the extent that students in the (now) lower-quality institutions benefit, in terms of an improved level of their general knowledge, from any pressures to meet national standards, both their potential productivity and competitive status in professional labor markets will be improved. To the extent that higher standards in such schools tend to eliminate marginal students from the pool of professional job-seekers, the average productivity of college graduates would be expected to improve.

On the basis of our arguments concerning the probable forms and uses of competence tests, it seems most likely that such tests would improve the efficiency of professional and managerial labor markets by (1) reducing marked variations in the quality of education provided by different educational institutions, (2) eliminating poorly-qualified degree-holders from competition, and (3) removing some existing barriers for non-degree-holders who have achieved competence outside the formal academic stream. What would happen to the demand for higher education, we have argued, depends largely on how well non-degree-holders succeed in passing the prospective test(s), and no firm judgment about this important factor can be made in the absence of experience. It seems likely, however, that aspirants to professional-level jobs would tend to place a high subjective value on whatever mode of learning seems most likely to ensure success on the competence test, and it is likely that formal education may be viewed by most as the best alternative.

It should be clear, however, that competence-based education can only be discussed in light of knowledge about what specific test is to be used. We have argued, in the main body of the report, that we have neither the technology to measure desirable attributes for jobs nor the knowledge needed to quantify trade-offs among attributes. We have argued here that, on a priori grounds, it seems unlikely that competence tests would measure anything different from attributes conferred by schooling. *

* But, and it is an important qualification, we have suggested that such a test might serve better than the mere holding of an academic degree as an indicator of these attributes.

COMPETENCY-BASED PROGRAMS IN HIGHER EDUCATION

Much of the a priori discussion of tests measuring competence is borne out by examining current practice of competency-based programs in higher education. The theoretical considerations about the possible uses of competency testing have not carried over to the organization of competency-based curricula experiments in higher education. A recent review of existing programs (Trivett, 1975) bemoaned the lack of theoretical postulates to justify these programs. It also stressed that objectives varied significantly from program to program.

The impact of competency-based programs upon the time needed to complete a degree has not been articulated clearly. On the one hand, competency-based programs have been suggested as a way to shorten the time needed to complete a degree program for more mature students. On the other hand, they may very well lengthen the time spent in an educational setting by students who enter it less well prepared than the average. The objectives of many of these programs are setting a floor to achievement and certifying that the recipient has achieved certain competencies.

The road to achieve this objective is difficult to map, since the actual implementation of competence-based programs has followed four streams. The first approach has the longest history, some six years in all, having been started by Alverno College, a small private Catholic institution, in 1971. As rather broad general goals, Alverno

lists eight "competences," viz.:

1. Develop effective communication skill.
2. Sharpen analytical capabilities.
3. Develop workable problem-solving skill.
4. Develop facility in making independent value judgments and independent decisions.
5. Develop facility for social interaction.
6. Achieve understanding of the relationship of the individual and the environment.
7. Develop awareness and understanding of the world in which the individual lives.
8. Develop knowledge, understanding, and responsiveness to the arts and humanities.

Similarly broad goals, such as (a) communications skills, (b) an understanding of the human community, (c) interpersonal relations, (d) quality of life and (e) the world of work, are enumerated as competencies in another program by De Paul.

In most instances, as the above examples show, the competencies are open to subjective interpretation, and intentionally vague so as to cover the hidden agenda of revitalizing the curriculum in rather undistinguished institutions. Both evaluators and site visitors comment that competency-based liberal arts curricula result in revolutions in the structure of the academic curriculum, with faculties placing great emphasis on course integration and commonality of intellectual approaches between disciplines. In a nutshell, the Great Books/St. John's (Annapolis) approach to curriculum is being tailored to suit less academically gifted students (see bibliography in Trivett, 1975).

Such realignment of instruction is difficult to implement in

any setting other than a small liberal arts college. In other institutions, where the faculty is discipline rather than teaching oriented, the integration of the curriculum is practically impossible. Larger schools have thus focused competency-based programs differently. For instance, in the University of Massachusetts, general competency programs in writing, reading, speaking and mathematics have been introduced for selected groups, mostly students from underprivileged backgrounds. A similar approach was suggested at Livingston College at Rutgers in New Jersey, where writing competence tests were to be introduced as a condition for graduation. The testing of basic skills at some minimum level can be considered as a second type of competency-based program, more easily to implement in a big school since it does not interfere with instruction in most subjects.

Thirdly, attempts to incorporate competency-based programs in professional or para-professional curricula are slowly getting off the ground. For instance, Florida State has been fleshing out competence standards in biology, nursing, and urban and regional planning. Seattle Community College is developing the training program for day-care-center managers and other workers in community service programs. Most of these curricula are influenced by competency-based theories for elementary and secondary education, and require that the curriculum be split into small units, with students demonstrating mastery of each unit. The philosophy of the program, borrowed from techniques originally

developed for measuring the performance of elementary and secondary students, is, according to evaluators, the exact antithesis of liberal arts programs. There is considerable doubt that these programs capture the essence of the post-secondary experience. Also, it has been argued that the burden of specifying a sufficient number of relevant skills and outcomes in detail will make it impossible to develop large numbers of such programs.

Finally, a number of exploratory efforts to determine the essential or important features in discipline-oriented programs have been mounted for executives (Bowling Green), lawyers (Antioch, Indiana Law) and medical doctors (Meharry, Southern Illinois University). None of them have progressed beyond exploring inventories of needed knowledge or description of the process. In those cases where two competency explorations were started in the same discipline, e.g., law and medicine, the approaches to the development of the curriculum have little in common and reflect the lack of consensus in professional fields.

The narrow gauge and lack of specificity of competency-based programs lead one to doubt that the competency movement will affect the operation of the major part of the post-secondary sector. In a few instances, e.g., De Paul, it may make it possible for persons in their middle years to be certified and graduated earlier than otherwise. In others, it is likely that competency-type testing will delay the graduation of sub-standard students.

No effort has been made to establish objective standards of testing in the rather small-scale development efforts to date. Thus, tests developed in one institution are not likely to be transferable to other settings. In addition, the involvement of other faculty, administration, students, and occasional community representatives generally precludes the development of consistent standards from year to year. The admirable idea of having competency certified by larger groups will probably act as a brake to developing national standards.

It is significant that the competency-based programs have not brought about (a) the setting of standards or objectives common to a large number of schools, nor have they (b) resulted in the adoption of the British system which requires that degree examinations be graded by professionals from a school other than the one attended by the student. The adoption of a general standard for degree recipients is not likely to be facilitated by present competency-based programs.

The discussion of the nature of tests, and their possible use by employers, and the above description of the actual implementation of competency-based curricula shows how far away we are from the implementation of a common performance floor for college degrees. It is impossible, in the light of past experience, even to guess where the floor would be set, if it were set nationally. The self-interest of faculties in schools with low-achieving students would not be served by setting the floor too high. Influential, prestige schools would object to setting

it too low. Neither group is likely to agree among themselves what should or should not be included in the test.

If a miracle were to occur, and such a test were to be instituted, given current developments in competency-based education, it is more likely to cover what economists refer to as general learning.

CONCLUSIONS

What aid or comfort does the policy analyst gain from these theoretical investigations? What changes in social policy regarding education can be justified as a result of these analyses, and on what grounds?

There is no simple answer to these questions because increased educational attainment affects society in more ways than one. Even a short discussion of the impact of education must include the following four rubrics: (a) education and economic growth, (b) education and the returns to the factors of production, (c) education and culture, and (d) education and citizenship.

In dealing with education and economic growth, the macro-economic impacts of education, one is forced to deal simultaneously with two topics: the increase in the productivity of labor arising from increased educational attainment, on the one hand, and on the other, the possible increases in productivity which may result from improvements in the allocative mechanisms dealing with labor (either those postulated by the screening hypothesis, or resulting from a more intelligent job search by persons with more education).

While addressing the relationship of education and returns to the factors of production, the so-called micro-economic impacts of education, one ought to be concerned about the magnitude of private and social returns to individuals, as they compare to returns of alternative

investments, and also with the effects which these returns have upon the overall income distribution. Under the rubric of culture and education, the following concerns may be included with the preservation and the dissemination of the tradition of our society, i.e., the effects of increased educational attainment on the development of creativity, the ability to accept new ideas, to tolerate change, etc. Perhaps, the most popular and most difficult to define impact of education is upon citizenship. It certainly goes beyond the mere attribute of voting in elections or avoiding convictions for criminal activity. It could encompass efficiency and skill in spending one's resources, in maintaining one's health, or in raising children more successfully.

These many-faceted effects of education (some documented and others not) make it difficult for the policy-analyst to conduct a straightforward, noncontroversial cost-benefit analysis of education. The often-heard criticism of cost-benefit analysis that the calculation is incapable of taking into account most non-pecuniary costs and non-pecuniary benefits has been very often mentioned in education. Such non-pecuniary benefits, difficult to measure, are likely to be found in every facet of the analysis of education and society. The pragmatic view of some economists that all things which cannot be measured are not important may not be shared by policy-makers.

The second set of difficulties in translating economic analysis into policy recommendations is that the relationship between increasing

educational attainment and productivity are not clear-cut, and there are serious disagreements among economists as to whether or not the interconnection can be quantified. Thirdly, policy implications of an economic result may be ambiguous. For instance, theory would prompt one to subsidize educational investment only until the returns to education are above those of other forms of capital. If, on the other hand, one wishes policy to achieve equalization of incomes, the extent to which the subsidy ought to continue beyond the point postulated above will depend upon non-pecuniary judgements, which cannot be easily translated into pecuniary terms. There is no simple algorithm which translates losses in the Gross National Product due to the inefficient allocation of capital resources to balance them off against a desirable change in income distribution. It seems superfluous to elaborate on both the conceptual and measurement problems relating to the link between education and culture and those between education and citizenship.

Thus, the formulation of rational, quantitatively based policies of social investment in education is limited. The pitfalls of ignoring value judgements are just as great as ignoring the results of quantitative analysis. The real challenge is to place the theoretical analysis in its proper perspective.

Can policy implications be drawn from theory?

There is little doubt that the advocates of the human capital approach are not as convinced of the completeness of their model as they used to be. This does not mean that the model is invalid. If one is willing to postulate rational behavior by workers and employers, one will agree with Blaug (Blaug, 1972) that it is possible to use the human capital approach for analytic purpose. He has argued that:

> (T)here is a sense in which all...explanations hold simultaneously. Employers pay educated people more, even when their education has taught them no specific skill, because they are more achievement-motivated, more self-reliant, act with greater initiative in problem-solving situations, adapt themselves more easily to changing circumstances, assume supervisory responsibilities more quickly, and benefit more from work experience and on-the-job training. They pay them more not only when they hire them but they go on paying them more throughout their working life. In short, they expect them to be more productive than less-educated people and the expectation is borne out. The weakness of (other explanations) is precisely that the advantages of more-educated people show up at every age throughout working life. Now we cannot have it both ways: Either the educational system is a superb discriminant of the sort of abilities industry demands, in which case we must conclude that this is the economic role of education until such a time that a better screening device is invented, or it is only a crude way of selecting people that misinforms as frequently as it informs, in which case it is not clear why employers do not correct their initial hiring mistakes. But of course that assumes that employers are continually tightening up the allocation of labour, which they would only do if they were subject to competitive pressures. We come back full circle, therefore, to the question of competition in labour markets. It is the action of competition in a labour market that allows (alternative) explanations to hold simultaneously.

> Contrariwise, the less are the pressures to compete, the weaker is the "economic explanation" and the stronger are those of the sociologist and psychologist. Thus, the much-publicised idea that education contributes directly to economic growth by the formation of "human capital," rather than indirectly by changing basic values and attitudes, rests ultimately on the belief that competition is at work in labour markets; without that, there is only presumption, not proof.

In response to an attack of his analysis, Blaug (Blaug, 1972a) stripped his argument of most of the underlying assumptions:

> Let us discard both macro- and micro-economic functions: there are no marginal products! Now let us ask whether the wage rate of different kinds of labour corresponds to their relative scarcities. Scarcity is a relation between demand and supply. But what governs the demand for labour if there is no marginal product labour in a meaningful sense? If I want to ask: are graduates more productive than primary school leavers, am I told this is a meaningless question?...I venture to think that the question will continue to be asked.

Even under these reasonable conditions, human capital theory has more to offer in policy formations in some areas than in others. Thus the constructs of the theory on the rate of return may be used to throw some light upon the desirable allocation of subsidies to education. The conclusions derived from an analysis of the rates of return should necessarily be tempered by considerations of economic mobility (Mundell, 1973), which may require some waste of resources to achieve social goals.

Implications of lower rates of return. The decline of the rate of return on higher education and training can be taken as a signal that the market for persons with some college and college degrees is saturated.

The current rates of return to individuals are already somewhat below the rates of return on alternative investments in capital, and even without reducing them any more for screening or other market imperfections, the subsidies to higher education are difficult to defend on productivity grounds.

These subsidies are even harder to defend if social rates of return are considerably lower because employers are irrational, education is used for screening, or the effects of a superior labor input, postulated by Arrow (Arrow, 1973) cause the private returns to exceed the social rates by a large margin. Only if one is willing to ascribe some less tangible effects to the higher educational achievement by claiming that education improves one's efficiency as a consumer (Michael, 1972), or produces other desirable behavior such as decreased fertility (Michael, 1973), or prepares one to accept innovations more readily (Schultz, 1975), can one defend subsidies in the light of the low rates of return, and still be a member in good standing of the neo-classical school.

Those economists willing to retreat to the less fashionable classic concepts may want to defend the subsidies on two different grounds. In the first instance, if we are willing to admit that the lower rates of return to education than to physical capital signify that part of the expenditures on education are consumption, and that only part is investment, the argument for the subsidy runs as follows: (1) education is surely a superior good, in the same category as the arts, music, or even the

maintenance of health, (2) there is a long tradition of subsidies for these superior goods, and there is little reason why a decision should not be made to include education among them.

Another argument in favor of financing post-secondary education has been mentioned in passing. By subsidizing the education of the children of the poor, one contributes to mobility among income classes. This argument has been presented at great length by Mundell (1973). In a recent review, Freeman (Freeman, 1973) has questioned whether we know enough about the marginal benefits of mobility to spend sizeable sums promoting it. Machlup (Machlup, 1973) is even more skeptical of the possible benefits of this mobility, especially in the absence of increased overall productivity. He stated:

> How strange that concerned persons, self-appointed arbiters of social values, should hold that upward-cum-downward mobility, where people merely trade their places in a given income distribution, is a good thing for society.

Although Machlup is willing to consider that the prospect of social and economic mobility could affect the overall productivity of the economy by encouraging the poor to work harder, he is not convinced that this proposition has been proved. A policy analyst may find himself on the opposite side of the issue from Machlup. He may argue that our society's productivity is quite satisfactory and that changing the mobility opportunities may be dangerous. Once again, there is no consensus among economists on an important policy issue.

Some additional limitations of the human capital approach.

While private rates of return may be important signals about the state of the market for persons with different levels of educational attainment, and some re-allocation of resources may occur as a result of labor market conditions, especially among students, by major field of study (Freeman, 1971), the human capital approach is not likely to contribute to short-run equilibrium between the demand and supply of persons with different levels of education. In theory, the prospects of lower earnings from incremental investments in education should result in lower enrollment rates. In practice, a long time may elapse before this equilibrium is reached. Certain conditions can be readily postulated, which will prevent a socially desirable equilibrium from ever being reached.

The delay in the equilibrium may occur because students mis-estimate their earnings prospects. Recent work by McMahon (McMahon, 1974), relating the income expectations of freshmen of the class of 1972, indicates that anticipated rates of return, especially for those who are planning to undertake graduate studies, are somewhat higher than is warranted by earnings patterns of persons with graduate education. Also, if part of the expenditure on education is viewed by students as consumption, the balance between socially desirable levels of investment and those which are likely to occur will never be reached.

Harry G. Johnson recently mentioned three "really tough questions" facing the economic analysis of higher education (Johnson, 1973):

> First, how far do we really believe in the ability of economic analysis to set up socially relevant standards of inequality in the educational field, standards which correspond to what the public is really worried about, and if we do, how could we improve the situation? Second, how far can we insist on a competitive cost-oriented system to finance higher education?... Third, if we insist on applying competitive principles to higher education, are we prepared to recommend cash redistributions of income to solve the poverty or the inequality problem, and insist on that too?

Economists, it appears, are reduced to a state of humility. The neo-classicists, the flower of the economic profession in the U.S., believe that education can be likened to a "black box," with unknown content. If one were to stretch this simile further, and make the size of the "black box" proportional to educational attainment, they would argue that size of the box and the productivity of workers are positively correlated. If one agrees with this proposition, there is little doubt that additional education will contribute to productivity. The still unresolved issue is the extent to which the present level, or increased, subsidies are likely to pay off in this field, as contrasted to subsidies to, say, health, child rearing or capital formation. As long as their understanding of the impact of education on productivity is imperfect, and the U. S. economy can get, at least, average marks for its productivity, it would be foolhardy to recommend drastic changes in policy.

The best use of information on the rates of return of incremental units of education is to disseminate this information to individuals.

A better understanding of the economic consequences of investment in their own human capital will allow students to make more rational decisions about the amount of education they desire. If they continue to over-indulge in education, they will do it for the right reasons: either to get a more pleasant job, or for other non-pecuniary reasons, such as the love of knowledge. A policy to broadcast the information on rates of return widely would, of course, place on social analysts the burden of being extremely careful in spelling out assumptions of conditions underlying their analysis and forecasts lest they mislead a large number of students or potential students.

REFERENCES

Albrecht, J. W., "The Use of Educational Information by Employers." Paper presented at the Winter 1974 Econometric Society Meetings.

Arrow, K. J., "The Economic Implications of Learning by Doing." Review of Economic Studies, 29 (1961) 155-73.

_____, "Higher Education as a Filter." Journal of Public Economics, V. 2, No. 3 (1973).

Becker, G. J., "Investment in Human Capital: A Theoretical Analysis." Journal of Political Economy, 70, No. 5, pt. 2 (1962) 9-49.

_____, Human Capital. New York: NBER, 1964.

Berg, I., Education and Jobs: The Great Training Robbery. Boston: Beacon, 1971.

Blaug, M., "The Correlation Between Education and Earnings, What Does It Signify?" Higher Education, V. I, No. 1 (1972) 53-76.

_____, The Cambridge Revolution: Success or Failure? London and New York: Institute of Economic Affairs, 1974.

Bowles, S., "Understanding Unequal Economic Opportunity." American Economic Review, V. 63, No. 2 (1973) 346-56.

_____ and Gintis, H., "The Problem with Human Capital Theory--A Marxian Critique." American Economic Review, V. 65, No. 2 (1975) 74-82.

Buros, O. K., ed., Tests in Print II. Highland Park, New Jersey: Gryphon Press, 1974.

Carnoy, M., and Marenbach, D., "The Return to Schooling in the United States." The Journal of Human Resources, V. 10, No. 3 (1975) 312-31.

Denison, E. F., The Sources of Economic Growth in the United States. Supplementary Paper No. 13. New York: Committee for Economic Development, 1962.

_____, "Capital Theory: Technical Progress and Capital Structure--Discussion." American Economic Review, V. 56, No. 2 (1966) 76-82.

_____, Why Growth Rates Differ. Washington, D. C.: The Brookings Institution, 1967.

_____, Accounting for United States Economic Growth 1929-1969. Washington, D. C.: The Brookings Institution, 1974.

Eckaus, R., "Economic Criteria for Education and Training." Review of Economics and Statistics, 46 (1964) 181-90.

Freedman, M., The Process of Work Establishment. New York: Columbia University Press, 1969.

Freeman, R. B., "On Mythical Effects of Public Subsidization of Higher Education." Does College Matter? Edited by L. C. Solmon and P. J. Taubman. New York: Academic Press, 1973.

_____, Market for College-Trained Manpower. Cambridge: Harvard University Press, 1971.

_____, "Overinvestment in College Training." The Journal of Human Resources, V. 10, No. 3 (1975) 287-311.

_____, "Youth Employment Opportunities: Changes in the Relative Position of College and High School Graduates," in Change in Labor Market Information for Youths, ed. by Seymour Wolfbein. Philadelphia: Temple University Press, 1975.

Froomkin, J. "Allocation of Resources to Education--Towards a Theory of Subsidy." Budgeting, Programme Analysis and Cost-Effectiveness in Educational Planning, Paris, O.E.C.D., 1969.

Harcourt, G. C., "Some Cambridge Controversies in the Theory of Capital." Journal of Economic Literature, Vol. 7 (1969) 369-405.

_____, Some Cambridge Controversies in the Theory of Capital. Cambridge University Press, 1972.

Hill, C. R., "Education and Earnings: A Review of the Evidence." (mimeographed)

Jaffe, A. J., and Froomkin, J., Technology and Jobs. New York: Frederick A. Praeger, Inc., 1968.

Jencks, C.; Smith, M.; Acland, H.; Bane, M. J.; Cohen, D.; Gintis, H.; Heyns, G.; and Michelson, J., Inequality. New York: Basic Books, Inc., 1972.

Johnson, H. G., "The Alternatives Before Us." Journal of Political Economy, V. 80, No. 3, part 2 (1972) 280-9.

Jorgenson, D., and Griliches, Z., "The Explanation of Productivity Change." Review of Economic Studies, 34 (1967) 249-83.

Kendrick, J. W., Review of Accounting for United States Economic Growth 1929-1969, by E. F. Denison. Journal of Economic Literature, V. 13, No. 3 (1975) 909-10.

L nholm, G. V., Review of Studies Employing GRE Scores in Predicting Success in Graduate Study, 1952-1967. Princeton, New Jersey: Educational Testing Service, March 1968.

Layard, R., and Psacharopoulos, G., "The Screening Hypothesis and the Returns to Education." Journal of Political Economy, V. 82, No. 1 (1974) 985-98.

Layard, P. R. G., Sargan, J. D., Ager, M. E. and Jones, D. J., Qualified Manpower and Economic Performance. London: Penguin Press, 1971.

McMahon, W., "Private Returns to Graduate Education." Paper presented to National Board of Graduate Education, July, 1974 (mimeographed).

Machlup, F., "Perspectives on the Benefits of Postsecondary Education." Does College Matter? Edited by L. C. Solmon and P. J. Taubman. New York: Academic Press, 1973.

Michael, Robert T., The Effect of Education on Efficiency in Consumption. New York: Occasional Paper 116, NBER, Columbia University Press, 1972.

_____, "New Economic Approaches to Fertility." Journal of Political Economy, 81, Part 2, March/Apr' 1973.

Mincer, J., "On-the-Job Training: Costs, Returns and Some Implications." Journal of Political Economy, Supplement, October, 1962.

_____, Schooling, Experience, and Earnings. New York: NBER, Columbia University Press, 1974.

Mundel, D. S., "Whose Education Should Society Support?" Does College Matter? Edited by L. C. Solmon and P. J. Taubman. New York: Academic Press, 1973.

Okner, B. A., and Rivlin, A. M., "Income Distribution Policy in the United States." Unpublished Manuscript, The Brookings Institution, 1975.

Parsons, Donald O., "The Cost of School Time, Forgone Earnings, and Human Capital Formation." Journal of Political Economy, V. 82, No. 2, part 1 (1974) 251-66.

Robinson, J., "The Production Function and the Theory of Capital." Review of Economic Studies, 21 (1953) 81-106.

Rogers, D. C., "Private Rates of Return to Education in the United States: A Case Study." Yale Economic Essays, 9 (1969) 88-134.

Samuelson, P. A., "A Summing Up." Quarterly Journal of Economics, 80 (1966) 568-83.

Schultz, T. W., "Capital Formation by Education." Journal of Political Economy, 53, No. 1 (1960).

_____, "Investment In Human Capital." American Economic Review, 51, No. 1 (1961).

_____, "The Value of the Ability to Deal with Disequilibria." The Journal of Economic Literature, V. 13, No. 3 (1975) 827-46.

Solow, R. M., "Technical Change and the Aggregate Production Function." Review of Economic Statistics, 23 (1957) 312-20.

Sraffa, P., Production of Commodities by Means of Commodities. Cambridge University Press, 1960.

Taubman, P. J., and Wales, T., "Higher Education, Mental Ability and Screening." Journal of Political Economy, 81 (1973) 28-55.

_____, Higher Education and Earnings. New York: McGraw-Hill Book Co., 1974.

_____, "Education as an Investment and a Screening Device." Education, Income and Human Behavior, edited by F. T. Juster. New York: McGraw-Hill Book Co., 1975.

Thurow, L., "Generating Inequality: The Distribution Mechanism of the Economy." (Draft Research Grant Report to the Office of Research and Demonstration Manpower Administration, U. S. Department of Labor) January, 1975.

_____, and Lucas, R. E. B., The American Distribution of Income: A Structural Problem. Washington, D. C.: Joint Economic Committee, 1972.

Trivett, David, Competency Programs in Higher Education, ERIC/Higher Education Research Report No. 7, American Association for Higher Education, 1975.

Welch, F., "Education in Production." Journal of Political Economy, V. 78, September/October (1970) 35-59.

Wiles, P., "The Correlation Between Education and Earnings: The External-Test-No-Content Hypothesis (ETNC)." Higher Education, V. 3, No. 1 (1974).

Wise, D. A., "Academic Achievement and Job Performance." American Economic Review, V. 65, No. 3 (1975) 350-66.

TABLE 1

UNADJUSTED MARGINAL PRIVATE RATES OF RETURN TO INVESTMENT IN HIGH SCHOOL AND COLLEGE, BASED ON INCOMES OF THOSE IN LABOR FORCE (UNEMPLOYED INCLUDED), BY SEX AND RACE, 1939-69, U.S.
(per cent)

	1939	1949	1959	1969 Income	1969 Earnings
White Males					
High School 12/8	49.1 (20.3)[a]	22.7	14.6	18.8	14.0
College 16/12	21.4 (16.3)[a]	13.2[b]	17.6	15.4	16.2
Black Males					
High School 12/8	27.1 (30.0)[a]	14.7	13.1	16.1	19.9
College 16/12	14.6 (5.9)[a]	7.7	13.9	14.3	13.6
White Females					
High School 12/8	25.2 (13.7)[a]	20.0	14.8	19.2	15.1
College 16/12	18.4 (14.8)[a]	11.0	12.2	17.0	14.9
Black Females					
High School 12/8	10.0 (11.6)[a]	15.2	12.9	11.6 (13.8)[c]	19.1
College 16/12	30.0 (21.2)[a]	17.0	19.1	19.6	19.4

Note: Corrected the male private rates for federal income taxes. We assumed the incomes were taxed at the single taxpayer rate (one exemption, standard deduction) up to age 22; the married taxpayer rate from age 23 to 26 (two exemptions, standard deduction); three exemptions, standard deduction from age 27 to 30; four exemptions from age 31.

TABLE 1 (Cont'd)

UNADJUSTED MARGINAL PRIVATE RATES OF RETURN TO INVESTMENT IN HIGH SCHOOL AND COLLEGE, BASED ON INCOMES OF THOSE IN LABOR FORCE (UNEMPLOYED INCLUDED), BY SEX AND RACE, 1939-69, U.S.
(per cent)

[a] Marenbach rates for the sample with zero incomes omitted.
[b] If it is assumed that the 16+ category in the 1949 Census represents 16.5 years completed rather than 16 years, the rate of return to college education for white males is 9.9 per cent.
[c] Rate adjusted for possible overestimate of income foregone.

Source: Income and earnings taken from U. S. Censuses for 1940, 1950, 1960 and 1970. M. Carnoy, and D. Marenbach, "The Return to Schooling in the United States, 1939-1969," The Journal of Human Resources, Vol. X, No. 3, p. 316.

TABLE 2

UNADJUSTED MARGINAL SOCIAL RATES OF RETURN TO INVESTMENT IN PRIMARY SCHOOL, HIGH SCHOOL, AND COLLEGE, BASED ON INCOMES OF THOSE IN THE LABOR FORCE (UNEMPLOYED INCLUDED), BY SEX AND RACE, 1939-69, U.S.
(per cent)

	1939	1949	1959	1969 Income	1969 Earnings
White Males					
Primary 8/0	11.6 (12.6)[a]	12.7	13.2	7.2	
High School 12/8	18.2 (11.3)[a]	14.2	10.1	10.7	9.0
College 16/12	10.7 (9.0)[a]	10.6[b]	11.3	10.9	11.0
Black Males					
Primary 8/0	10.5 (14.7)[a]	13.9	10.6	6.3	
High School 12/8	10.4 [a] (14.2)	9.1	8.3	9.0	11.2
College 16/12	6.5 (2.7)[a]	4.6	7.2	8.0	7.7
White Females					
Primary 8/0	4.7 (10.9)[a]	7.8	3.9	neg.	
High School 12/8	12.7 (9.6)[a]	11.5	9.3	8.3	7.4
College 16/12	9.8 (8.6)[a]	7.0	6.6	9.4	7.9

TABLE 2 (Cont'd)

UNADJUSTED MARGINAL SOCIAL RATES OF RETURN TO INVESTMENT IN PRIMARY SCHOOL, HIGH SCHOOL, AND COLLEGE, BASED ON INCOMES OF THOSE IN THE LABOR FORCE (UNEMPLOYED INCLUDED), BY SEX AND RACE, 1939-69, U.S.
(per cent)

	1939	1949	1959	1969 Income	1969 Earnings
	Black Females				
Primary 8/0	6.8 (8.1)[a]	9.8	4.8	4.2	
High School 12/8	4.8 (6.3)[a]	8.7	8.2	6.9 (7.6)[c]	10.3
College 16/12	11.1 (10.0)[a]	9.2	8.8	10.5	10.6

Source: See Table 1.

TABLE 3

CHANGING VALUE OF COLLEGE TRAINING FOR MEN, 1959-74[a]

	1959	1969	1 [illegible]	1974
Estimates of discounted before-tax lifetime incomes, at age 22[b]				
1. 4 years of college	79,400	99,200	95,100	86,800
2. 4 years of high school	71,500	87,100	88,100	86,000
3. Difference (1) - (2)	7,900	12,100	7,000	800
Estimates of discounted after-tax lifetime incomes, at age 22[c]				
4. 4 years of college	69,100	87,400	85,400	77,800
5. 4 years of high school	65,800	80,300	82,100	80,100
6. Difference (4) - (5)	3,300	7,100	3,300	-2,300
Direct costs of college[d]				
7. Social	7,060	9,300	9,950	10,120
8. Private	1,650	2,130	2,280	2,330
Net values of 4 years of college				
9. Net social value (3) - (7)	840	2,800	-2,960	-9,120
10. Net private value (6) - (8)	1,650	4,970	1,020	-4,630
Internal rate of return (to nearest 1/2 per cent)				
11. Social	10.5	11.1	9.5	7.5
12. Private	11.0	11.5	10.5	8.5

[a] All dollars are in constant 1967 dollars.
[b] Estimates use 10 per cent interest rate for discounting. Income of college graduates from age 18 to 21 assumed to be one-fourth of high school graduates.
[c] After-tax incomes obtained by subtracting from income the individual income tax liability for that particular income group.
[d] "Social costs" obtained by dividing current fund educational and general income by total enrollments to obtain per student figures. "Private costs" estimates by student tuition and fees less student-aid income per enrollee.

Source: Richard B. Freeman, "Overinvestment in College Training," The Journal of Human Resources, Vol. X, No. 3, 1975, p. 296.

TABLE 4

REALIZED RATES OF RETURN TO EDUCATION
NBER-TH SAMPLE
PEOPLE ENTERING COLLEGE IN 1946
(per cent)

Education Categories	Private (Before Tax) Not Deflated	Social (Before Tax) Not Deflated	Social (Before Tax) Deflated
High School to:			
Some College	15	14	11
B.A.	11	10	8
Some Graduate	8	7	5
Master's	8	8	6
Ph.D.	4	4	2
L.L.B.	12	11	9
Some College to B.A.	7	7	5
B.A. to L.L.B.	13	12	10

Source: Paul J. Taubman and Terence J. Wales, "Higher Education, Mental Ability, and Screening," Journal of Political Economy, Vol. 81, Number 1, January/February, 1973, p. 40.

TABLE 5

PROPORTION (b'/b) OF EARNINGS DIFFERENTIALS DUE TO EDUCATION (MALES, UNITED STATES)

Course	b'/b	Main Variables Controlled For: Original	Main Variables Controlled For: Additional	Source	Sample
Higher Education	.65	Age	Ability, family background, marital status, health	Taubman and Wales (1973)	NBER sample of World War II veterans
B.A.	.97	Age	Ability	Hause (1972)	NBER sample
B.A.	.87	Age	Ability	Hause (1972)	Rogers (1969) (see below)
Years of schooling after military service	.88	Age, schooling before service, color, length of military service	Ability, father's status, place of schooling	Griliches and Mason (1972)	Bureau of the Census sample of postwar veterans
Years of schooling	.56	Age	Family size, father's occupation and income	Bowles (1972)	Mainly U.S. Census survey data
Years of schooling	.57	Age	IQ, father's occupation, and portion of ability and occupation not due to education	Jencks (1972)	Mainly March 1962 Current Population Survey data

TABLE 5 (Cont'd)

PROPORTION (b'/b) OF EARNINGS DIFFERENTIALS DUE TO EDUCATION (MALES, UNITED STATES)

Course	b'/b	Main Variables Controlled For: Original	Main Variables Controlled For: Additional	Source	Sample
B.A.	.86	Age	IQ, parental class, religion, marital status, number of jobs	Rogers (1969)	Eighth graders in certain Connecticut schools, 1935
High School	.73	Age			
B.A.	.82	Age, race, region	Place of residence, hours worked, marital status, family size, region of birth	Hanoch (1965)	Census 1959

Source: R. Layard and G. Psacharopoulos, "The Screening Hypothesis and the Returns to Education," Journal of Political Economy, Vol. 82, No. 5, 1974.