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1. Education, Income, and Human Behavior: Introduction and Summary

by F. Thomas Juster

INTRODUCTION Precise quantification of the influence of educational attainment on human behavior is one of the most important and sensitive questions facing decision makers, whether they be private individuals concerned with their own resource allocation or government officials concerned with issues of public policy. The collection of chapters in this volume represents an attempt to provide some quantitative and qualitative judgments about the nature and extent of education's influence on behavior.

Economists have come to look on the process of formal schooling as reflecting an investment decision of those being educated and for society as a whole. Formal schooling requires an investment of student time in addition to direct monetary outlays for tuition and living expenses, and the influence of these schooling investments persists over an entire lifetime. Not only are occupational status and lifetime earnings strongly associated with education, but time of marriage and choice of marriage partner, family size, consumption and saving allocations, sociopolitical attitudes and values, use of leisure time and work-leisure choices, etc., are also likely to be influenced by the amount of investment in education.

Part One of the volume contains eight chapters that focus on direct financial returns to individuals. The main emphasis is on the analysis of differentials in salary or earnings rates, that is, on the degree to which educational attainment produces higher annual and lifetime earnings by increasing the value of time spent in the labor market. A subsidiary but important question is the way in which educational attainment influences the allocation of time between market and nonmarket activities, that is, the effect of education on labor force participation and on the way in which nonmarket time is allocated among alternative uses.

The analysis in this part of the volume provides the most precise

documentation to date of the magnitude of direct financial returns to education. The rate-of-return estimates are obtained from sets of data in which it is possible to adjust, almost for the first time and certainly with greater precision than before, for the earnings impact of many important factors that both influence earnings and tend to be directly associated with education—measured (presumably innate) ability, family background, and so forth. The chapters in this part also examine the relation between investment in formal schooling and the shape of lifetime earnings profiles, the impact of differences in educational investments on the observed inequality in the distribution of earnings, and the role of educational differences among parents in producing educational differences in their children—possibly one of the most important mechanisms involved in the intergenerational transmission of earnings and the distribution of earnings.

The general theme of the chapters in this part is that differences in human skills and knowledge (human capital) are a major determinant of differences in the level and time profile of labor market earnings and that these differences in skills and knowledge are in turn determined by differences in human capital investments that range all the way from time spent by parents with preschool or school-age children, through time and resources used in formal schooling, to time invested in labor market learning experience. These investments cumulate through time, being very heavy in the early childhood and school-age years and tapering off at different points during the working lifetime. They are, of course, subject to depreciation and obsolescence, and they are a basic determinant of the lifetime earnings profile.

Part Two focuses on the nonmonetary returns to educational attainment. If education enhances productivity in the job market, it might also be expected to influence behavior in other areas as well, either because it affects the efficiency with which individuals combine available resources to achieve given objectives or because behavioral responses themselves depend systematically on factors associated with educational attainment. The chapters in this part cover a wide range. They examine the influence of educational attainment on traditional economic variables like consumption, saving, and the selection of investment portfolios; they also investigate a number of questions that have customarily been of more concern to social scientists other than economists, e.g., fertility and family size, participation in illegal activities; and a collection of social,

political, and economic attitudes. The chapters in Part Two analyze a significant part of the possible nonmonetary returns to educational attainment and thus constitute a significant beginning to an analysis of the full range of returns that can be attributed to formal schooling.

For analytical convenience, the benefits (both positive and negative in principle) of educational attainment can be divided into *monetary* and *nonmonetary* returns and, within each of these broad classes, into *private* returns (those accruing to the individual being educated) and *social* returns (those that cannot be collected by the individual and thus accrue to society as a whole). This volume focuses mainly on the private monetary and nonmonetary returns, although a number of chapters provide insights into some of the social returns as well. Not surprisingly, the most unambiguous results relate to private returns and, within those, to monetary returns.

THE IMPACT OF EDUCATION ON EARNINGS The most easily measured and most often analyzed influence of educational attainment is its impact on earnings in the job market. A number of subquestions, important for both theoretical understanding and the formulation of public policies, can be distinguished:

1 What is the net influence of formal schooling in generating income differentials, as distinct from the combined influence of schooling and other variables that tend to be correlated with formal training, such as family background and mental ability?

2 Does the contribution of ability to income vary with the level of formal schooling and other factors, or is the influence of ability on earnings essentially independent of the levels of other variables?

3 What are the roles of less-formal kinds of education, such as learning on the job and parental training, in both the generation of earnings and the relation between formal schooling and earnings?

4 What specific types of formal schooling or ability, as opposed to rather general measures of both, influence earnings, and how can they be measured?

5 What are the effects of both formal schooling and informal training and learning on the time path of lifetime earnings and on the capital value (discounted present value) of earnings?

6 What is the role of formal schooling in explaining the distribution of both individual and family earnings and income, and have changes in the dis-

tribution of educational attainment over time increased or diminished earnings inequality?

7   What is the precise nature of the productivity-enhancing skills imparted by the process of formal education, and does all the observed earnings differential from education represent a return to higher skills?

Trends in Educational Attainment and Mental Ability The chapters in Part One provide some answers to all these questions, although evidently better answers to some than to others. As a useful starting point, we can begin by examining the historical association between mental ability or IQ and formal schooling attainment. Over the past several decades in the United States the number of youngsters attending institutions of higher education has risen sharply. In the 1920s, less than 20 percent of the eligible population went on to receive more education; in the 1960s, close to 50 percent of the eligible population went on to do so.[1] What has been the impact of this huge increase in the proportion of college-bound students on the average quality of college students or on the ability of the average college freshman? Has this unprecedented expansion seriously diluted quality? Are students who entered college during the 1960s less well equipped to benefit from additional education than the much smaller numbers who matriculated during earlier decades?

A useful framework within which to analyze the historical relation between mental ability and educational attainment is to ask what would happen to the average ability of those entering college on the alternative assumptions that (1) colleges always exercised the maximum degree of selectivity in their admissions policy or (2) college admissions policies were based on random selection. As Figure 1-1 shows, if colleges always exercised the maximum degree of selectivity, i.e., admitted students in descending order of ability, starting with the most able until all available places were filled, an expansion in the proportion of the population attending college would necessarily be associated with a systematic decline in the average ability of entering freshmen. Such a policy would also, incidentally, necessarily result in a systematic decline in the average ability level of the population *not* entering college. For example, at the extreme at which only 1 percent of the population attends col-

[1] Interestingly enough, there is not much difference between the 1920s and the 1960s in the proportion of high school *graduates* going to college; the big difference between these periods is in the proportions of the eligible population that complete high school training.

FIGURE 1-1 *Illustrative relation between average ability and proportion of high school seniors attending college*

Percentage of high school seniors going to college
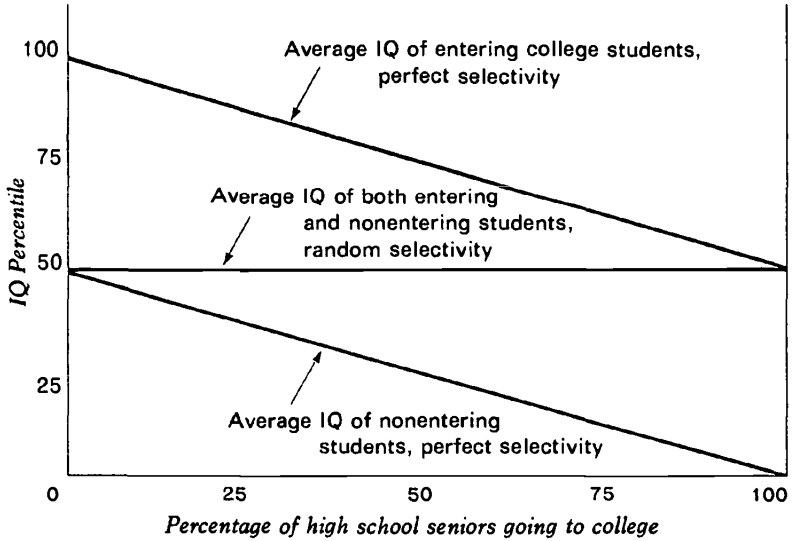
lege, only the most able students would be admitted, and average ability for entering freshmen would be in the 99th percentile, whereas average ability for the noncollege population would approximate average ability in the population as a whole. At the other extreme, at which almost everyone would be admitted to college, the average ability of entering freshmen would approximate the average for the population as a whole, and average ability for those (few) not entering college would be in the lowest (first) percentile. Thus, if colleges exercise maximum selectivity and the proportion of young people going to college increases, the average ability of entering freshmen must decline. On the other hand, if colleges admit students at random, average ability levels for both the college and noncollege populations would be equal to each other and to the population average and would be independent of the proportion going to college.

Those who feared that the great upsurge of postwar enrollments in colleges would lead to a deterioration in the average quality of students entering colleges must implicitly have had in mind a model in which college admission policies were highly selective. But Chapter 2, by Taubman and Wales, demonstrates conclusively that exactly the opposite has been true: Not only has there been no decline over time in the average ability of entering freshmen, but there

has been a systematic tendency for average ability to increase. Much of the increase has resulted from an extremely rapid rise (from 50 percent to about 90 percent) in the proportion of the most able (upper tenth) high school seniors attending college and from almost as rapid an increase in the proportion of students in the upper quarter attending college. At the same time, the Taubman-Wales evidence indicates that the average ability of high school seniors not going to college has declined steadily over time. Thus, the average difference in ability between high school seniors entering and not entering college has steadily widened, from about 8 percentile points in the 1920s to approximately 27 in the 1960s.[2]

These results bear importantly on analysis of movements over time in the rates of return to different levels of educational attainment. Other things being equal, the rapid rise in the proportion of the labor force with higher educational attainment would be expected to reduce the financial returns to investment in higher education, but the strong secular increase in average ability for those receiving a college education would be expected to offset any tendency for rates of return to higher education to decline. Similarly, the declining proportion of the labor force with no more than a high school education would, other things being equal, be expected to result in higher returns to that level of educational attainment, but the declining average ability of non-college-bound high school seniors would tend to operate in the other direction. Hence, observed rates of return to college or high school training will not necessarily be inversely related to the changes in relative supply that have occurred over the last several decades, since changes in relative quality tend to work in the opposite direction.

Earnings and Educational Attainment That additional amounts of formal schooling tend to be associated with additional earnings in the labor market is a widely documented and universally acknowledged fact. The magnitude of the earnings differential, however, and the rate of return to investment in formal

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[2] Two facts should be kept in mind. First, in the data used here, ability is *defined* in such a way that the average cannot change over time — in effect, the measure discussed is actually relative ability. However, there is evidence, cited in the Taubman-Wales chapter, which suggests that absolute ability levels have in fact remained constant.

Second, the decline in average ability for non-college-bound students does not depend on the fact that the average for college-bound students has risen; as Figure 1-1 shows, it is perfectly possible for *both* averages to decline — and even likely that they would.

schooling are highly uncertain. Most studies show that rates of return to primary and secondary schooling are very high relative to returns on other forms of capital investment—a range of 20 to 30 percent or more is representative.[3] Estimates of returns to higher education tend to run somewhat lower, on the order of 10 to 15 percent for most studies. Yet it is rare to find estimates of returns to educational investment that account explicitly for all potentially important nonschooling influences on earnings. Hence, the estimated rates of return incorporate rough adjustments, if any, for the possible effects on earnings of variables such as ability, family background, and preschool investments by parents.

The chapters in this volume cover three subjects relating to the earnings return to formal schooling. The chapter by Mincer, "Education, Experience, and the Distribution of Earnings and Employment: An Overview," examines the role of formal schooling and of work experience in determining the observed distribution of labor market earnings at different points in the working lifetime. The chapters by Taubman and Wales, "Education as an Investment and a Screening Device"; Hause, "Ability and Schooling as Determinants of Lifetime Earnings, or If You're So Smart, Why Aren't You Rich?"; and Wachtel, "The Returns to Investments in Higher Education: Another View" represent attempts to estimate returns to formal schooling from samples of data in which explicit measures of variables like mental ability and family background are available.

The Mincer, Taubman and Wales, and Hause chapters are concerned almost entirely with the returns to investment measured in years of schooling. The Wachtel chapter involves a study of the effect of differences in the cost (and presumably quality) of formal schooling; Taubman and Wales also present some preliminary estimates of the earnings differentials associated with college quality differentials.[4]

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[3] Estimates of rates of return to elementary school, although at the high end of this range, are subject to serious problems of both estimation and interpretation. There are no good data on forgone earnings for those who do not complete elementary schooling, although Fair Labor Standards legislation has probably increased rates of return by reducing the earnings opportunities of the very young. In addition, rates of return to elementary schooling are probably influenced by North-South differences in completion norms—traditionally six years for elementary school in the South and eight years in the North. I am indebted to Finis Welch for pointing out these considerations.

[4] Research at the National Bureau of Economic Research is under way on the question of returns to schooling quality. See the fifty-first *Annual Report* of the NBER.

The chapter by Leibowitz, "Education and the Allocation of Women's Time," examines differences, by education, in time spent in the care and training of preschool and school-age children, perhaps one of the principal ways that economic wealth (the capacity to produce income) is transmitted from one generation to the next. The final chapter in this part, "Measuring the Obsolescence of Knowledge," by Rosen, examines the question of how educational capital changes over an individual's lifetime, as it increases because of knowledge obtained in the labor market (learning) and depreciates because of obsolescence or physical wear and tear on the person in whom the educational capital is embodied.

Running through all these chapters is the common assumption that all investment in humans — taking the form of formal schooling, postschool learning and training in the labor market, or preschool learning and training at home — constitutes part of the accumulated stock of educational "capital" embodied in a person. Consequently, observed differences in the level, distribution, and lifetime profile of financial earnings realized by individuals in the market can, in considerable part, be explained by differentials among persons in their stocks of such capital. In effect, the underlying theme of these chapters is that individuals begin life with a certain amount of potential capital in the form of genetic endowment; they add to that capital throughout early childhood, school years, and the early working years; and they suffer deterioration or depreciation of that capital as their learning or training becomes outmoded or obsolescent. Further, the observed distribution of employment, wage rates, and occupation is determined largely within the framework of investment quantities and rates of return to these investments.

This is not to say that the only impact of human capital or of its formal schooling component is on observed market earnings and returns. Many would argue that the most significant impact of formal schooling is not on earnings at all, but on such diverse and diffuse variables as social and community behavior and responsiveness, efficiency in achieving welfare objectives within given financial constraints, and the development of constructive and cohesive attitudes, without which participatory government would function ineffectively or inequitably. Some of these other possible impacts of formal schooling on behavior are examined in the chapters in Part Two. In Part One, however, the focus is on direct monetary returns to formal schooling.

The conceptual framework of human capital accumulation pro-

ceeding through part of the working lifetime as well as in school is central to Jacob Mincer's chapter, "Education, Experience, and the Distribution of Earnings and Employment: An Overview." In fact, Mincer's earlier work constituted the first systematic analysis of the critical distinction between earnings as observed in the market and true earnings as reflected by the combination of observed market earnings and (unobservable) investment in learning.[5] The point is worth some additional emphasis. Modern human capital theorists recognize that the accumulation of embodied capital in humans extends far beyond the domain of formal schooling. Schooling was the earliest recognized and the most easily measured form of such investment and has therefore been given most attention by economists and other social scientists. But it is now recognized that additional capital is accumulated in the form of job market learning simultaneously with the earning of current income. Both the Mincer and the Rosen chapters, discussed later on, emphasize this aspect of the relation between human capital and lifetime earnings. In addition, as will be pointed out in connection with the Leibowitz chapter, it is beginning to be as widely recognized that preschool investments in children by parents, as well as continuing parental investments during schooling years, may represent a significant addition to the stock of human capital, although serious empirical investigation of that subject is just beginning.

Mincer's chapter is concerned mainly with the impact of educational and other human capital differences on the distribution of individual and family earnings, in regard both to the cross-sectional structure of earnings differentials and to changes in the structure over time. Basing his analysis on a human capital earnings function that is simple yet powerful in its ability to explain observed differences in earnings, Mincer finds that over 60 percent of the inequality in 1959 annual full-time earnings of white urban males can be attributed to differences in the distribution of investments in human capital. The distribution of formal schooling itself explains only about one-fourth of the total variance in income, while the distribution of postschooling investment explains perhaps another quarter. Differences in schooling costs for given numbers of years account for perhaps another 10 percent of observed inequality.

Since part of the variance in annual earnings is due to differences

[5] See his "On the Job Training," *Journal of Political Economy,* October 1962. (Supplement.)

in hours and weeks worked per year, and since some of this difference is systematically related to human capital differences, perhaps another 10 percentage points of income variance can be accounted for by systematic human capital differences in hours and weeks. Thus over 70 percent of normal or long-run income inequality can be attributed to differences in human capital stocks.

Mincer's chapter provides strong evidence for several propositions that are often a source of dispute among social scientists. The first is the significance of learning on the job as a source of both human capital investment and consequent future earnings; the second is whether the deceleration in earnings growth late in the working life represents a biological aging phenomenon or a conscious decision to reduce investments in additional learning, and hence future income, because the payoff period has shortened.

On the first point, if schooling investments were the only form of human capital investments, the correlation between years of schooling and earnings would be strongest in the early years of employment and would continuously decay over time. The observed pattern is that such correlations increase for about the first decade of working life and then tend to decline. The explanation suggested by Mincer is that the initial postschooling distribution of observed earnings reflects not true earnings, but the combination of observed market earnings plus earnings forgone by investing in learning opportunities. Since such investments will tend to increase observed market earnings through time, the distribution of observed earnings after a number of years of experience will better resemble the distribution of true (full) earnings immediately after the completion of schooling. Thus the schooling–observed earnings correlation should rise with experience, reaching a maximum before the first decade of earnings experience is completed, and then decline; this pattern is revealed in the empirical data.

On the second point, the question is whether chronological age or labor market experience provides a better explanation for observed earnings profiles. The answer yielded by the data is clear-cut: labor market experience is clearly the more powerful variable, and age has no influence on earnings once labor force experience has been accounted for.[6]

[6] The same point is forcefully documented in a recent study by B. Malkiel and J. Malkiel, "Male-Female Pay Differentials in Professional Employment" (1973). This study focuses mainly on sex differentials in earnings, and the difference between age and experience variables is especially strong for women.

The findings on the relation between schooling and the distribution of employment provide some valuable insights into a number of related questions. First, the pattern of labor force participation systematically differs by educational level. Males with more education evidently begin work later in life, but they also remain longer in the labor force; thus, the resulting differences by education in working lifetime are minimal. In effect, time spent in school before the start of the working life is roughly offset by additional time spent in the labor force at the close of the working life. For females, labor force participation rates are systematically higher as levels of formal schooling rise, with the interesting exception that participation rates are about the same for women with preschool or school-age children. Thus women with more education are more likely to be found in the labor force unless they have young children at home, in which case labor force participation is actually a little less likely — a finding discussed more fully in the Leibowitz chapter.

The explanation for these phenomena, in the case of women, probably lies more on the side of differences in labor supply functions than on the side of differences in labor demand functions. Differences in amounts of formal schooling imply differences in market productivity, but not necessarily the same kind of difference in productivity in the home or outside the market. Thus persons with more formal schooling and hence higher market wage rates will tend to substitute time spent in the market for time spent elsewhere, whether it be do-it-yourself chores about the house, cooking and cleaning, or housekeeping generally. In effect, observed differentials among educational groups in the amount of time spent in the labor force may result from the fact that those with more schooling, and hence higher market productivity, tend to substitute market for nonmarket time. Although one would expect that higher hourly and annual earnings would also result in a tendency to substitute leisure for working time, the net result of both effects together might well be that the more highly educated spend more time in the labor force. And, as mentioned earlier, the labor supply effects apply much more directly to women. The differential productivity argument is even more clearly applicable to women, among whom differences in labor force participation related to educational differences are much sharper.

The contribution of the Taubman-Wales and Hause chapters lies in their attempts to filter out from the observed (gross) returns to educational differences a measure of the influence on earnings of

both mental ability and family background, thus arriving at a more truly "value-added" estimate of returns to formal schooling. The Taubman-Wales chapter analyzes this problem with the aid of two essentially new bodies of evidence. One comprises the unpublished detailed tabulations from a study of males who graduated from high school in 1938 and were surveyed in 1953 to determine earnings and education beyond high school.[7] Measures of both IQ and high school rank in class are available as proxies for ability. The sample contains unknown but possibly serious deficiencies, especially in terms of response bias. Nevertheless, the evidence from this sample suggests that only a slight bias exists in estimating returns to educational attainment when the ability variable is omitted from the analysis. However, ability is an important determinant of earnings in its own right.

Results using the other new sample are somewhat different. This sample, designated NBER-TH, was originally drawn in 1955 by Professors Thorndike and Hagen (Columbia Teachers College) from some 75,000 males who had taken a battery of United States Air Crew Aptitude Tests during the second half of 1943. The Thorndike-Hagen sample of some 10,000 was resurveyed by the NBER in 1969: data were obtained on earnings and occupational history, education, family background, nonmarket activities, and a variety of sociopolitical attitudes.[8]

In the NBER-TH sample, it turns out that the bias due to omission of ability ranges from 12 to 30 percent of the estimated gross returns, depending on the earnings period and on the interpretation of variables that could represent either parental or ability influences. The bias in estimated returns appears to be especially serious for those in the highest-ability classes — roughly the upper tenth of the ability distribution. Taubman and Wales also find that the relatively stronger influence of schooling on earnings for those in the upper end of the ability distribution is found only if some graduate training has been obtained.

The chapter by Hause provides a different view of the nonlinear or nonproportional influence of education on earnings. Hause is concerned primarily with the question of proper statistical specification of the relation between measured ability or IQ, formal school-

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[7] The sample, originally obtained by Dael Wolfle and Joseph Smith, is described in "The Occupational Value of Education for Superior High School Graduates," *Journal of Higher Education,* vol. 27, pp. 201–213, 1956.

[8] The NBER-TH sample is described more fully in App. A.

ing attainment, and earnings. One common specification assumes that the dollar amount of earnings can be expressed as the sum of the effects of schooling attainment in years and IQ. But that specification implies that the effect of schooling on earnings is independent of IQ and, similarly, that the effect of IQ on earnings is independent of schooling; hence the return to additional schooling is no greater for those with high ability than for those with average or low ability. But the costs of additional schooling are likely to be higher for those with greater ability, since their forgone earnings are likely to be greater. Hence the arithmetic and linear specification implies that investment in schooling should be more profitable for those with low rather than high ability, a result contrary to observed investment patterns.

More appropriate specifications involve using either the relation between schooling, IQ, and the log of earnings — which implies a proportional effect of ability on dollar earnings (i.e., that *rates* of return are independent of ability) — or a specification that allows the effects of ability to depend on the level of formal schooling, but does not constrain the nature of the dependence. Using these alternatives, Hause reexamines the data originally obtained by D. C. Rogers from a Connecticut sample of high school graduates and also investigates data from Project Talent, the NBER-TH sample described above, and a set of Swedish data (Husén sample). He finds that the coefficient of ability in earnings functions, estimated for each schooling subgroup, tends to be a function of the level of formal schooling; that is, the returns to ability are relatively low for those with only a high school education and tend to rise as one examines subgroups with increasing amounts of formal schooling. These findings are consistent with a model in which ability and schooling interact to produce significantly higher incomes than would have been predicted by a linear combination of the two. The finding is significant, since it provides empirical support for what has been suspected by many for some time: that the rate of return to educational attainment is influenced by the level of basic ability and that the returns to those with one or more college degrees increase with the level of basic ability.

Evidence on the rate of return to investment in higher education is also found in the Taubman-Wales chapter. Such estimates use the observed-earnings differential between those with different amounts of schooling as the "return" and the costs of the extra schooling as the "investment": costs include both direct costs such

as tuition and indirect costs such as forgone earnings. Correcting for the influence of ability and family background on earnings, the Taubman-Wales calculations indicate that social rates of return range, in real terms, from 11 percent for those with some college (but no degree) to around 2 percent for those with a Ph.D. degree. Rates of return for those with an undergraduate degree are about 8 percent, on the average. Private rates of return, which differ from social returns both because the direct investment (schooling) costs are usually subsidized and because the taxes paid on actual earnings tend to be proportionally higher than those on forgone earnings, tend to be somewhat larger. These range from 15 percent for those with some college (but no degree) to about 4 percent for those with a Ph.D.;[9] they are about 11 percent for those with an undergraduate degree.[10] These estimates of rates of return are a bit lower than previous ones, presumably because the data permit a more accurate correction for the impact of nonschooling variables, such as ability and family background, on earnings. Except at the graduate level, Taubman and Wales do not find that rates of return vary with ability, although the amount of schooling clearly does — being higher for those with greater ability.[11]

On the basis of evidence that is subject to considerable controversy, Taubman and Wales argue that these estimates represent probable upper limits to the augmentation of skills by higher education and reflect in part the fact that employers use educational at-

[9] These rates of return are of course direct monetary returns only. Thus the existence of significant nonmonetary returns, as is often alleged to be the case for Ph.D. holders, would imply relatively low observed monetary returns.

[10] There may be some downward bias in these rate-of-return estimates, stemming from the heavily entrepreneurial nature of the NBER-TH Air Force sample. Both high school graduates and college dropouts in the sample include a heavy proportion of independent business proprietors whose reported earnings presumably include a return to financial assets. Taubman and Wales find that the returns to college graduates are affected appreciably by the fact that the estimated forgone earnings include returns to financial assets, but they also find that the returns to "some college" are about the same as for college graduates after the appropriate adjustment.

[11] A priori, it is not at all obvious that rates of return to schooling will necessarily depend on ability. As Becker pointed out in his seminal essay on income distribution, demand *functions* for education may well depend on ability level, but whether price (rate of return) varies with ability depends on the supply functions (for investment funds) as well. To take one simple case, if everyone had access to funds for educational investments in unlimited amounts at a constant price, rates of return would be constant at the margin, and the quantity of education would vary with ability.

tainment as a relatively inexpensive screening device; that is, employers require a college degree for certain kinds of jobs on the grounds that this approach is more likely to be successful in identifying potentially productive employees or that it involves lower costs (at least for the employer, if not for society) than the use of alternative testing devices. In this interpretation, only part of the observed earnings differential reflects a return to the skills imparted by education; the remainder represents an "agency fee," which the employee gets because it is cheaper for employers to screen via a diploma than by independent measures of potential performance.[12]

This interpretation rests on evidence concerning the returns to educational differences *within* given occupational categories, since earnings differences due to education-related productivity differentials are most easily observed this way. Its controversial nature is due in part to the fact that very little of the within-occupation variance in earnings can be explained at all in the Taubman-Wales data, and hence a very large part of the total variation is due to causes which could not be identified and which might or might not be systematically associated with particular characteristics of the individuals involved. To the extent that the unidentified sources of variation in earnings within occupations are systematic rather than random, the observed effects of education on earnings could well be poor estimates of the true effects. On the other hand, the relatively modest ability of these equations to explain variance is equally characteristic of general earnings functions based on the sample used by Taubman and Wales; hence the empirical results are not necessarily unpersuasive.

The chapter by Paul Wachtel, "The Returns to Investments in Higher Education: Another View," represents one of the first attempts to relate future earnings returns to the quality as well as the quantity of schooling investments. For the most part, researchers have been limited to information on relatively simple measures of educational investment such as number of years completed, and have used these data to analyze the relation between schooling investments and future earnings. But there are marked differences among schools in the amounts of resources used, and there are correspondingly wide differences in the private costs (tuition, fees,

[12] By its very nature, the screening question is difficult to analyze empirically because productivity differentials are usually not observed directly, but are inferred from income differentials.

etc.) actually paid by those attending schools. The variation in re-
sources used and private costs among schools is probably greater
for schools of higher education than for other institutions, since for
the most part schooling through the secondary level involves com-
pulsion, public support for all costs, a commitment to minimum
standards, and a comparatively homogeneous curriculum — all of
which tend to reduce variability in resources. For higher education,
both private costs and resource costs can and do vary much more
widely. For example, private costs are often zero (full scholarship
aid), whereas the variation in resource costs between a school with
low faculty salaries and large classes and one with high faculty
salaries and small classes can be enormous.[13]

Wachtel's chapter examines the relation between cost differences
among institutions of higher education and the associated earnings
streams of graduates. Using a model that represents an elaboration
of the basic human capital earnings function discussed in the
Mincer chapter, he divides schooling investments into an indirect
(forgone earnings) and a direct (tuition expenditures) component.
Rates of return are estimated for each of these investment com-
ponents and for investments adjusted for various assumptions
about part-time earnings that would tend to reduce forgone earn-
ings. Adjustments are also made for tuition and living-cost sub-
sidies allowed under post-World War II educational programs.

The results indicate that the rate of return on the total social
costs of educational investments for these World War II veterans
is relatively low compared with estimates from other studies:
Returns to undergraduate schooling are about 5 percent, and
allowance for part-time work increases the rate of return to just
under 7 percent. But if allowance is made for the tuition and living-
cost subsidies that would have been received by members of this
sample, private rates of return tend to be about the same as else-
where — 10 percent or more. Returns to graduate training are mark-
edly lower than those to undergraduate training, a result consistent
with other findings.

There is, however, a considerable difference between the returns

[13] Variation in the resource costs of schooling is primarily a function of variation
in faculty salaries and student-teacher ratios and of the correlation between
them. For elementary and secondary schools, the homogeneity of curricula
and the strength of teacher organization tend to reduce variation both in teacher-
pupil ratios and in salaries. Jencks reports that 30 of the 50 states spent be-
tween $600 and $880 per pupil in 1969–70 on the average, with the extremes
ranging from $1,237 to $438 (Jencks et al., 1972, p. 24).

to different investment components. Wachtel finds that the returns to the forgone earnings component of investment are very small once the direct investment component reflected by tuition fees or expenditures is accounted for: instead of 5 percent, rates of return are as low as 1 or 2 percent. However, there is a substantial return to direct investments, suggesting that higher-cost (and higher-quality?) institutions considerably enhance the incomes of their graduates. Rates of return on direct investments tend to run from 10 to 15 percent. A possible implication, which cannot really be tested with the data at hand, is that part-time attendance at institutions of higher education would yield substantially higher economic benefits than full-time attendance, since the forgone earnings investment, which yields a very small economic return in these data, would be greatly reduced. In effect, taking these results literally suggests that people could increase the overall rate of return to their educational investments by attending higher-cost (and presumably higher-quality) institutions on a part-time basis, thus increasing direct investment costs and reducing indirect ones.[14] However, there are no observations on differences in the returns for students with different combinations of direct and indirect investments, since the data do not enable us to distinguish part- or full-time college attendance.

The question of differential returns to those with different ability levels or socioeconomic backgrounds is also explored in Wachtel's chapter. He finds that the rate of return is positively associated with ability or IQ, and also with favorable socioeconomic background. Breaking the investment costs into indirect and direct components indicates that at least part of this differential is attributable to the fact that those with more ability or favorable socioeconomic backgrounds tend to get higher overall returns because they invest in higher-cost education and hence their indirect and direct investment costs are distributed differently.[15] That is, the overall rate of return to high ability or favorable socioeconomic

[14] An alternative interpretation is that the low return on forgone earnings reflects the high direct consumption benefit of full-time attendance at colleges and universities, which would (or might) be lost for part-time attendees.

[15] The conclusions here differ from those reported by Jencks (1972, p. 24), since these results imply that greater resource use produces a return in the form of higher eventual earnings for education beyond 12 years. Jencks argues, on the basis of indirect evidence, that there is no such effect for elementary and secondary schools. The results reported here, as well as in Jencks, standardize for other inputs besides schools.

background reflects the fact that the investments of these groups tend to be larger per year spent in school and that direct investments of this sort yield relatively high returns. Thus the interaction between ability and schooling observed in the chapter by Hause, for example, may in part reflect the inadequacy of schooling years as a measure of schooling investment.

On balance, what the Taubman-Wales, Hause, and Wachtel chapters suggest as reasonable estimates of the financial returns to investment in higher education are numbers significantly smaller than roughly comparable estimates of returns to physical capital investments. This is more clearly the case for estimates of social returns; the estimated private returns, when adjustments are made for the subsidization of investment costs, are only slightly less than returns to physical capital. On the other hand, none of these calculations includes either private nonmonetary returns to investment in schooling (some of which are examined below) or social monetary or nonmonetary returns. Although quantitative evidence is lacking, the analysis in Part Two suggests that these represent a significant addition to private financial returns.

In addition, of course, none of these estimates takes any account of the fact that the benefits of schooling include some direct consumption flows to those being educated, in addition to whatever investment returns will be obtained only in future years. What we tend to categorize as an "investment" in schooling really ought to be partitioned into a part that represents costs incurred for direct consumption benefits and a part that would be incurred only if the future returns were sufficiently high. Finally, although the private financial rates of return discussed above are significantly lower than the observed returns to investment in other forms of capital assets, they are not lower than the typical borrowing costs associated with such investments except (in the case of teachers, for example) where there is reason to suspect the existence of sizable private nonmonetary returns.

It is well to keep in mind that the rate-of-return estimates described above are still subject to potentially large uncertainties relating to the possible impact on earnings functions of factors excluded from the analysis. The earliest rate-of-return estimates were crude largely because they could not explicitly account for the impact of variables such as ability and family background, which are positively correlated with education and which add to earnings.

The estimates above remedy these particular deficiencies to a considerable extent and are thus much more net or "pure" estimates of the monetary return to educational investment. But we are still some distance from having the kind of income-generating function needed to identify the true net influence of educational attainment, since some of the important variables in a complete income function have yet to be taken into account.[16]

To illustrate, economists and other social scientists have recently begun to pay close attention to the possible role of preschool investments in children by parents, as it affects subsequent educational attainment. This question is examined in one of the chapters in this volume. Parental influences of this sort may also have effects on market productivity and earnings over and above any impact on school performance, and if so, returns to education can be affected. Although the results reported in this volume standardize for something called "family background," they do not account for the possible influence on earnings of different amounts of parental time spent with preschool or school-age children.

To show the potential importance of these kinds of factors, it is worth pointing out that cultural background as reflected by religious preference has a very powerful influence on observed earnings in both the Taubman-Wales and the Hause chapters. In the data sets used for both chapters, respondents were asked to report their religious preference as among Protestant, Catholic, Jewish, and other (including none). Taking account of family background factors like father's and mother's education and occupation, variables for both Jewish and Catholic religious preference have a significant (positive) impact on observed earnings (NBER-TH sample) relative to respondents reporting a Protestant preference. The Jewish religious preference variable also shows a significant impact on earnings in the Rogers sample.

Although the precise factors reflected in these religious preference variables are unknown, plausible hypotheses are that they reflect differences in the cultural background to which respondents were exposed during their formative years, or differences in the quantity or quality of parental time inputs, rather than differences

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[16] In particular, we have not developed and tested models that permit returns to decline as average educational levels rise. The estimates discussed above relate to returns reflected by current incomes and hence past education; they do not necessarily predict future returns.

in specifically religious values or practices. The appropriate research stance seems clear. The existence of strong statistical differences in behavior patterns associated with religious preference variables — or, as in other studies, with variables reflecting race or sex — points toward the existence of forces whose influence needs to be better understood and more fully interpreted, rather than toward an inference of causal relationships from observed statistical associations.

Another interesting piece of evidence bearing on the same question, from the NBER-TH sample, is the strong influence on earnings of the education of the respondent's father-in-law. The basic data set contains information on the educational level of the respondent's wife as well as that of both his father and father-in-law. In regressions of earnings on sets of socioeconomic background variables, it was consistently true that the impact on the respondent's earnings of his father-in-law's educational level was much stronger than that of his father's educational level. The causal nexus involved in this relationship is not necessarily from education to earnings; for example, relatively successful men may tend to marry women from relatively high socioeconomic backgrounds, and such women would tend to have relatively highly educated parents. It is, of course, possible to hypothesize a chain of causation that runs in the opposite direction. The main point is that we have just begun to understand and investigate the full complexity of the income-generating function, and although the chapters in this volume make significant strides beyond results reported elsewhere, they are still some distance from providing a full understanding of the role of educational differences in the generation of income differences.

Education and Labor Force Participation   Arleen Leibowitz's chapter, "Education and the Allocation of Women's Time," is concerned primarily with the effect of women's (time) investment in children on the supply of their labor to the market. Leibowitz examines the relation between the labor supply of married women and their educational attainment, as well as the relation between education and specific types of nonmarket activities like housework and child care. A model of labor force supply is developed in which hours worked by married women are a function of husband's earnings, potential earnings rate as reflected by educational attainment, differential labor market productivity of husbands and wives as reflected by the difference in educational attainment, and the number and age distribution of

children. The model specified that married women will enter the labor force when their productivity in the market exceeds their productivity at home, with the former estimated from educational level and the latter dependent on the number and age distribution of children. The basic argument is that the rearing and training of children is a relatively highly productive activity for married women and that their productivity in this activity is enhanced by formal schooling.

The results for labor supply are relatively clear-cut and largely consistent with the model's prediction. For younger women without children, weeks worked are greater as the level of education increases. The explanation advanced is that market productivity is higher, relative to home productivity, for more highly educated women: market productivity is strongly and positively associated with education, whereas home productivity is either unrelated or less strongly related to education. For women whose children are grown, labor force participation rates are also higher for those with more education, again for the same reason. But for women with young children of preschool or school age, the amount of labor supplied to the market is essentially independent of educational level, being roughly the same for all groups. Leibowitz also finds that, adjusting for the influence of the husband's wage rate, age, and other relevant variables, weeks worked by women with young children decline more sharply as the level of formal schooling increases, although declines set in for women of all educational backgrounds. Relating labor supply to the difference between productivity in the market and productivity in the home, these results suggest that the presence of young children in the home sharply increases productivity in the home relative to the market and that this effect is especially strong for women with higher levels of educational attainment.

Leibowitz next turns to an examination of data more directly related to productivity in the home. She examines three sets of time-use data[17] for married men and women that distinguish two types of activities in the home: those related to cleaning, cooking, and home maintenance generally and those directly related to child care.

The data indicate that there are systematic differences in the

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[17] The data sets are the Cornell time-use study, the Purdue sample, and the sample of Parisian households.

distributions of time use for women with different educational backgrounds. There appears to be little aggregate difference in total amount of hours devoted to home production in all the above categories, but the distribution of time between home maintenance activities and child care varies sharply by educational level. Women with more education spend less time in activities related to home maintenance and considerably more time in activities related to child care. The same also appears to be true of the husbands of women in the sample; time spent with children is substantially higher for husbands with more highly educated wives.

The explanation suggested by Leibowitz is that with more education, women generally attempt to substitute both market goods and capital assets in performing home maintenance. That is, such women make greater use of capital equipment (washing machines, vacuum cleaners, etc.) and devote less of their own time to home maintenance. But in the care and training of children, women with more education apparently tend to regard the substitution of the time of others, or the use of purchased services, as less desirable than more intensive use of their own time, suggesting that they place a relatively higher value on the use of their time in child-raising activities.

The results reported in the Leibowitz chapter bear directly on the question of intergenerational transfers of wealth and also on the interpretation of the common finding that the private monetary returns to higher education are lower for women than for men. A decade ago intergenerational wealth transfers tended to be analyzed in terms of transfer of monetary or financial capital. It is now increasingly recognized that a major part of intergenerational wealth transfers are apt to consist of the accumulation of human capital in its broadest sense. What the Leibowitz chapter suggests is that an important role of the educational system is to increase the amount of educational capital not only among those being educated but in their offspring as well and that the second effect is especially important for the educational capital invested in women. Thus examination of differentials in market earnings for women may give a distorted picture of the true returns to educational investment, since a significant part of the total return accruing to female schooling may be in the subsequent buildup of skills, knowledge, etc., that they transmit to their own children. Although we still have a long way to go in understanding the nature and extent of

this intergenerational transfer of human capital, the Leibowitz chapter represents a promising start.[18]

Earnings Profiles and Obsolescence

The last chapter in Part One is concerned more with the effects of postschool investment on earnings than with the effect of formal schooling. Rosen analyzes the relation between embodied knowledge at the completion of formal schooling, growth in knowledge through learning by experience in the labor market, depreciation-obsolescence rates on accumulated knowledge, and the lifetime profile of earnings. In Rosen's model, individuals implicitly purchase various combinations of current income and learning options in the labor market depending on their choice of occupation, and their decisions are made with the object of maximizing discounted lifetime earnings. Learning options are purchased by accepting jobs offering lower current income in return for the opportunity to invest in capital accumulation. The cost of learning varies with individual skills or abilities, and perhaps with the level of embodied knowledge reflected by formal schooling, as well as with the type of job chosen; the return depends on the length of working lifetime over which additional learning can yield income and on the rate of depreciation-obsolescence.

Thus individuals make sequential choices over a working lifetime. In the early years they tend to accept jobs carrying relatively large learning options and to switch to jobs with smaller or no learning options in their mature working years. These choices imply a path of net investment in knowledge following the completion of formal schooling: Net investment is positive during the early working years, reaches zero at some point, and eventually becomes negative toward retirement as capital stocks are allowed to run down.

It is not possible in the empirical work to distinguish between differences in learning efficiency among individuals and differences in depreciation-obsolescence rate; only the combined effect of both can be estimated from the available data on observed earnings. The evidence suggests that relative to depreciation-obsolescence rates, college graduates are as efficient and probably more efficient learners than high school graduates. Therefore, part of the observed

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[18] Additional research in this area, now in process at the National Bureau of Economic Research, is described in the Bureau's fifty-first *Annual Report.*

differential in lifetime earnings between college and high school graduates may be due to the greater efficiency with which college graduates are able to accumulate knowledge, thus leading them to invest more in postschool training. This effect should be distinguished analytically from the simple fact that college graduates have higher lifetime earnings because of their larger investment in formal schooling; the learning efficiency gain can be thought of as adding to any differential due to greater knowledge or greater all-around ability.

In addition, the evidence can be used to indicate a lower limit for depreciation-obsolescence rates; this limit appears to be more severe (15 percent) for high school graduates than for college graduates (10 percent). Finally, Rosen finds no evidence of "vintage" effects of schooling on high school graduates[19]; that is, there is no evidence that high school graduates of several decades ago acquired less knowledge in high school than current high school graduates do. Considered in conjunction with the evidence in the Taubman-Wales chapter on changes over time in the average ability of high school seniors not going to college, Rosen's evidence on lack of vintage effects can be read as implying that "value added" in high schools has actually increased significantly over time. The Taubman-Wales data clearly indicate that the average ability of non-college-bound high school seniors has declined markedly over the last several decades. Hence if these same high school graduates end up being just as efficient learners as high school graduates in the past, it must be because the effectiveness of schools has increased sufficiently to offset the decline in student ability. Rosen's methodology can be tested adequately only with larger samples than have been available up to now, and his empirical conclusions must be viewed as tentative. More definitive tests will be permitted by analysis of the 1970 census samples that are now being made available to researchers.

THE IMPACT OF EDUCATION ON BEHAVIOR The second set of chapters in this volume examines the impact of differences in educational attainment on a wide range of both economic and noneconomic behavioral variables. The distinction between the two is not sharply drawn; "economic" behavior refers simply to aspects of behavior that economists have conventionally been concerned with.

[19] Other investigators do find so-called vintage effects. For example, see Finis Welch (1972).

The first three chapters in Part Two examine the relation between education and consumption or saving behavior. In "Education and Consumption," Robert Michael examines the impact of formal schooling on the efficiency of consumption decisions. Next, Lewis Solmon, in "The Relation between Schooling and Savings Behavior: An Example of the Indirect Effects of Education," explores the effects of education both on aggregate savings behavior and on portfolio decisions involving the optimum form in which to hold savings. In "Education, the Price of Time, and Life-Cycle Consumption," Gilbert Ghez explores the life-cycle profiles of income and consumption and the association between these profiles and the level of educational attainment. The fourth chapter, "On the Relation between Education and Crime," by Isaac Ehrlich, explores the association between educational attainment and the propensity to participate in illegal or criminal activity. Next, Robert Michael, in "Education and Fertility," examines the impact of education on family size. Attention is given to the number of children, their distribution over the childbearing years, and their "quality" as reflected by the expenditure of both money and parental time. The final study, "The Influence of Education and Ability on Salary and Attitudes," by Albert Beaton, examines the relation between years of schooling and an extensive array of basically qualitative variables including parental education and occupation, perceived attitudes about the effectiveness of various aspects of formal schooling, voting behavior, general sociopolitical attitudes, and aptitude test scores.

As a group, the chapters in Part Two cover an important set of areas in which one might expect to find evidence of different behavior resulting from differentials in schooling levels and in which the benefits yielded by education are not measured directly in monetary terms. Much has been said and written about the effects of education in "improving" attitudes, values, and behavior. Little hard empirical analysis, however, has accompanied these judgments, which by and large can fairly be characterized as impressionistic. Although the studies reported in Part Two of this volume do not cover anything like the full range of potential nonmonetary benefits, and also do not have much to report on the benefits that accrue to society rather than to the individual being educated, they do constitute an important start in replacing casual impressions of the nonmonetary benefits of education with solidly grounded empirical findings.

Consumption and Saving The first chapter in Part Two, "Education and Consumption," by Robert Michael, focuses on how education affects the efficiency with which households are able to obtain a flow of utility from a given flow of money income earned in the market. The basic model used by Michael is a household "production function," in which final outputs (utilities) are produced within the household by combining inputs of goods or services purchased in the market, the time of family members, and the stock of capital owned by the household. Thus the output "dinner" of specified nutritional content and palatability is produced by combining inputs of raw or semifinished materials (food as purchased in the market); the housewife's time in terms of preparation, cooking, etc.; and services of the capital assets represented by kitchen appliances, tables, chairs, etc.

Michael sets forth the hypothesis that education affects the efficiency with which households combine various inputs in order to produce the optimum set of outputs. In this model, education is viewed as affecting productivity largely by way of enhancing the ability to process information, to evaluate new ideas and techniques, to make decisions in the face of imperfect information, to acquire new information in a relatively less costly manner, etc. If this is the way that education operates on the household decision-making process, one would anticipate that, other things being equal, households with more education should be able to get more outputs out of a given quantity of inputs.[20]

The empirical work is based on the view that education should act much like an increase in money income insofar as household decisions are concerned; that is, if education increases household efficiency in the manner described above, households whose members are more highly educated have the equivalent of greater money income and should therefore act in the same way as households that actually possess greater money income. Thus for commodity classes that are relatively responsive to differences in money income, more education ought to be associated with more consumption, money income held constant; but for commodity classes that are relatively unresponsive to differences in money income, the net association between education and consumption ought to be negative. For example, we observe that households with higher incomes are apt to expand purchases of the category "food eaten

[20] The hypothesis that a major influence of education is to enhance information-processing skills has been argued forcefully by Finis Welch (1970).

away from home" by an amount that is more than proportional to the difference in income. In technical terms, the income elasticity of demand in this category is greater than 1. If higher levels of educational attainment are equivalent to an increase in money income, they ought also to be positively associated with purchases of food eaten away from home, money income held constant.

The empirical results are generally consistent with the efficiency model: In analyzing very broad product categories like "goods" and "services," goods have an income elasticity less than 1, whereas services have an income elasticity greater than 1; the education elasticities are, respectively, negative and positive. Analyzing more refined commodity groups shows a positive association between income elasticity and education elasticity, and the predicted sign of the education elasticities is found in commodity categories representing anywhere from 60 to about 90 percent of total expenditures, depending on the categories included. These quantitative estimates of the impact of educational differences on the enhancement of real income are very rough, ranging from an elasticity of less than one-tenth (e.g., a 1 percent increase in the number of years of schooling raises the household's real income by about one-tenth of 1 percent) to an elasticity estimate of about one-half. The magnitude of the effect cannot be estimated more precisely, given the limitations of the data used for the analysis, although additional refinement is both possible and desirable.

On balance, Michael's chapter suggests an important avenue through which education produces a positive return—in this case, a return totally appropriated by the person being educated. The evidence also suggests that the size of the consumption efficiency return is far from negligible and may represent one of the most important sources of economic gain from investment in formal schooling.

The chapter by Lewis Solmon analyzes the impact of educational differences on propensities to save as well as on the allocation of savings among alternative investment vehicles. In "The Relation between Schooling and Savings Behavior: An Example of the Indirect Effects of Education," Solmon documents the proposition that aggregate saving behavior (especially if one considers the unobservable variable saving plus investment in learning opportunities) is systematically influenced by differences in the educational attainment of the household head; efficiency in portfolio decision making is similarly influenced.

Several possible lines of argument suggest that differences in educational attainment might result in differences in saving behavior. For the most part, the causality tends to run by way of the impact of education on either the level, time path, or variance of income and thence to saving, rather than directly from education to saving. For example, those with higher levels of formal schooling are more apt to be independent proprietors or professionals and are likely to have higher saving propensities because the variance of business and professional earnings tends to be greater than the variance of wage or salary earnings. Other factors that might influence decisions to save are (1) the declining rate of return to investment in formal schooling, which suggests that those with more education are apt to have lower discount rates; (2) the negative association between education and family size, which, as described in a later chapter by Michael, can be attributed to an efficiency phenomenon; (3) the later date of entry into the labor force for those with more education, which should result in a greater tendency to save during the (somewhat shorter) working lifetime;[21] (4) the probable greater efficiency in portfolio management of the more educated, which increases the returns to savings; and (5) the possible effect of educational level on time preference or foresight. The last two factors represent the only influences that run directly from education to saving rather than through the effect of educational differences on income.

In addition, a conceptually more appropriate definition of income and saving suggests that higher educational levels are very likely to be associated with higher "full" saving relative to "full" income. As the Mincer and Rosen chapters in Part One point out, the evidence suggests that there is substantial investment in on-the-job training during the early working years and that such investment is likely to be positively correlated (in dollar amounts) with investment in formal schooling. Hence, observed earnings in the early working years underestimate true earnings by the imputed cost of investment in learning and training on the job (i.e., the difference between observed earnings and what the individual could earn on a job with no learning opportunity). This entire differential can be considered to be invested or saved.

Solmon presents a variety of empirical results using a selected

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[21] It was mentioned earlier that working lifetimes are in fact very little different for those in different educational categories, since retirement ages tend to be positively related to educational attainment.

sample of households derived from the membership of Consumers Union of the United States. Estimates are presented including and excluding income and saving in the form of on-the-job training, and separate estimates are given for different educational groups as well as for the entire sample, with interaction terms between educational level and income. On the whole, the results offer strong support for the simple descriptive proposition that those with more formal education tend to save more out of a given income than those with less formal education. This is clearest from regressions estimated separately for families with different levels of formal schooling. Those with less than a high school education have the lowest propensity to save out of income; those with at least one graduate degree have the highest propensity; and other groups fall appropriately in between. Regressions that combine all groups and use income-education interactions do not show significant differences among educational levels when standard definitions of saving are used.

Results using the full-income and full-saving definition are stronger, as one would anticipate, because of the positive association between formal schooling and investment in on-the-job training. Here both the separate regressions for educational groups and the overall regression with interaction terms show significant differences in saving as a function of educational level, with the results uniformly supporting the hypothesis that those who have had more education save more than others.

These results do not necessarily demonstrate a wholly independent influence of differences in educational attainment on saving propensities. It is difficult to construct an unambiguous test of whether educational level affects time preference and foresight. Nonetheless, the results are consistent with the hypothesis.

One additional result is the relation between a subjective estimate of household saving plans and actual saving by educational level. Inclusion of a saving-plan variable reduces the net influence on actual saving of a variable like income, since higher planned saving is found among families with higher income. But the coefficient of saving plans, which represents the degree to which such plans are carried out, is generally higher for households with higher levels of educational attainment, a result consistent with the notion that one of the effects of formal schooling is to expand the time horizon of the household and to increase its awareness of the future relative to the present.

The saving-plan results may turn out to reflect what could be one of the most significant impacts of schooling on behavior—an increased awareness of the future consequences of present actions and a modification of behavior to take better account of those consequences. And the impact of education on present versus future choices might also be one of the most important ways in which additional education results in behavior patterns that provide not only direct benefits to those being educated but also an increased flow of indirect benefits to society as a whole. A society whose citizens are able to strike a better balance between present and future claims on resources is surely one in which all manner of decisions, ranging from personal financial ones to population and fertility ones, are more compatible with improvements in the general welfare.

Solmon's chapter also examines the relation between educational attainment and a collection of attitudes with respect to savings objectives, efficiency in portfolio selection, and risk. Differences in the attitudes of sample members are strongly associated with differences in levels of educational attainment, standardizing for the influence of other variables like income, age, and number of children. The results suggest that families with more education are likely to place much more weight on saving for the purpose of educating children and providing for inheritance, whereas educational level is negatively associated with savings objectives such as building up a business or providing for emergencies.

These relationships can plausibly be interpreted as reflecting both the distinctive characteristics of occupational choice as it relates to educational level and a positive association between educational level and orientation toward the future rather than the present. Highly educated persons have a greater stock of human capital and, on balance, expect both relatively rapid increases in income and less short-term variability in income due to transitory factors like unemployment. Thus providing for emergencies looms as less important for more highly educated heads of families, and such families are apt to have already made sufficient provisions for the future, so that saving to build up capital in the form of owned businesses is also a less-important objective. The concentration of responses by the more educated on saving to provide for children's education and for inheritance seems clearly associated with a longer view of the relevant horizon for family decision making.

Respondent preferences for particular types of assets in a port-

folio clearly indicate a perceptible gain in the efficiency with which assets are managed as educational level rises, as well as a markedly lower degree of aversion to risk on the part of highly educated families. Holding income and age constant, respondents with more education were much less likely to prefer asset forms like savings accounts and savings bonds and much more likely to prefer common stock, real estate, or mutual fund investments. Unlike the former, the latter are all variable-price assets with a significant degree of risk as well as a higher expected rate of return under the kind of conditions experienced in the United States over the past several decades. Thus the marked preference for both higher yield as well as riskier assets on the part of the more educated population suggests a difference in efficiency that facilitates a higher return to savings.

Other preference patterns indicate that more educated families are more aware of the capital gains potential in certain forms of investment and of the consequences of inflationary price changes and that they are better able to adjust portfolios to those changes. Such families are much more concerned with expected yields on investments than with safety of principal or current return. All these patterns can be interpreted as reflecting a positive association between rational investment policy and level of educational attainment, as well as a markedly greater ability on the part of the more educated to adapt their portfolio decisions to changing economic circumstances.

Thus in the area of saving behavior and portfolio choice, we find evidence to buttress the findings reported elsewhere in this volume: Differences in educational level have a major impact on the ability of individuals to adjust to changing circumstances, whether the question includes managing their economic affairs in the labor market, managing their own private financial affairs as consumers and investors, or planning the number and spacing of their children. And in a world where information flows are growing exponentially and where optimal decision making requires the efficient processing of increasingly large amounts of new information, the ability to adapt effectively to changes is likely to be of major importance.

The chapter by Gilbert Ghez, "Education, the Price of Time, and Life-Cycle Consumption," is also concerned with the impact of differences in educational attainment on consumption behavior, but its emphasis is on the lifetime profile of consumption rather than its structure or the efficiency with which households make

consumption decisions. The model developed by Ghez suggests that the lifetime consumption path is determined by the pattern of life-cycle variation in wage rates. According to Ghez, a change in wage rates will generate four different types of effects on consumption, some of which are offsetting:

1 An increase in wage rates will raise the cost of using time rather than market goods in the production of household output, thus inducing a substitution of goods for time.

2 An increase in wage rates will raise the cost of household activities (outputs) that are relatively time-intensive, thus inducing a substitution toward activities that are relatively goods-intensive.

3 If wage rates are expected to increase, the cost of time-using activities will be higher in the future than at present because the price of time will be higher, thus encouraging a substitution of consumption away from the future toward the present.

4 Unforeseen or imperfectly foreseen increases in wage rates will increase consumption because they result in greater wealth (higher discounted future income) for the household; "windfalls' of this sort tend to increase consumption when they are received.

Assuming that wage rates typically tend to rise over most of the life cycle, the effects of the first and second of these influences should produce an unambiguously positive correlation between wage rates and consumption of goods. The effect of the third factor is an unambiguously negative correlation between consumption and wage rates, whereas the wealth effects depend on whether unforeseen changes in wage rates are positive or negative. Ghez assumes that expectations are unbiased and hence that changes in wage rates have no net wealth effect on consumption.

The empirical tests of this model, conducted on the 1960 BLS survey of consumer expenditures, indicate that consumption is positively related to wage rates for each educational class; thus the first two effects outweigh the third. The wage rate coefficient is a bit higher for the highest education class, but is not consistently or strongly related to education. For example, households with a head having 12 or more years of schooling increase consumption by about six-tenths of 1 percent for every 1 percent change in earnings, whereas families headed by those with eight or fewer years of schooling show a bit less response. One might argue that educational attainment is positively associated with a higher level of certainty about future income, which in turn might mean less

reluctance to expand consumption as current earnings rise. The argument is plausible but speculative.

Although the empirical results are consistent with Ghez's model, in which the positive association between wage rates and consumption is explained by the substitution of goods for time (resulting from the higher price of time associated with rising wage rates), that is not the only possible explanation of this result. In the Ghez model, as pointed out earlier, it is assumed that there are no overall wealth effects on consumption because expectations are judged to be unbiased. Ghez argues that the mean difference between expectations about wage rate changes and actual wage rate changes is best regarded as zero for any given group, although there may be positive and negative deviations for individual group members. But the argument supposes that people will act as if they were absolutely certain of receiving the expected wage rate (presumably the observed mean wage for their group) and hence that positive consumption effects for those whose realized income exceeds expectations will be offset by negative consumption effects for those whose income falls short of expectations.

Uncertainty itself, however, may affect the adjustment of consumption to income. People expecting a given increase in income may plan to increase consumption by less than would be the case if their expectations were certain, simply because the cost of being wrong is too high. If I plan consumption on the basis of my best estimate of expected income, I could be in serious financial trouble if things turn out less well than anticipated. If things turn out better than anticipated, nothing much is lost but an opportunity to consume now and to improve the distribution of consumption between present and future. Thus the existence of uncertainty itself is a possible explanation for the positive correlation between wage rates and consumption. The slight but positive association between the wage rate–consumption correlation and educational level seems compatible with that hypothesis — there probably being relatively less variance in the distribution of expected income changes for those with higher levels of education.

The next three chapters examine aspects of human behavior (criminal activity, fertility, and attitudes) that have traditionally been ignored by economists. The chapter by Isaac Ehrlich, "On the Relation between Education and Crime," explores an area in which the indirect effects of education on behavior are of major potential importance. Ehrlich first develops a model to explain

individual participation in illegal activities. Unlike many of the implicit models used by criminologists and psychologists, Ehrlich's model specifies that the motivations that underlie decisions to engage in illegal activities are similar to those underlying decisions to engage in legal ones; i.e., criminal activity is viewed as an alternative "occupation" to working at a regular income-producing job.

In this view of the world, the decision to engage in illegal activity is made because the expected income from that occupation is greater than the expected income from more traditional forms of work. The payoff from illegal activity consists of the expected rewards (the loot, in more common parlance), modified by the probability of being apprehended or convicted. The payoffs from normal economic activity are simply the expected values to be derived from earnings from work. Thus individuals are assumed to react to opportunities and costs; some will decide that the opportunities in illegal activities are greater than those in legal activities, and/or that the costs are less, and vice versa for others.

Educational attainment could enter the model in a number of possible ways. First, education may act as an efficiency parameter and may influence efficiency (productivity) equally in both illegal and legal activities. If so, one would not be able to tell a priori whether more education tends to increase or decrease participation in illegal activities. For example, there may be certain kinds of illegal activities in which more education does not pay off because it has no effect on the efficiency with which the activity is carried out, does not lower the probability of apprehension or conviction, and has no influence on anything else. Since higher education always yields some return in legal activities, in this case higher levels of education would be associated with a reduced incentive to engage in criminal activity. Alternatively, educational differences might have the same productivity-enhancing influence on illegal activity for all individuals, but might tend to enhance market productivity more for some than for others and hence result in a differential incidence of criminal activity among different groups.

Finally, differences in educational attainment might have an impact on the supply (law-enforcement) side of an illegal-activities model. In Ehrlich's work the demand for illegal activities is related to the economic incentives of the participant, whereas the probabilities of apprehension and conviction are related to the resources employed in law enforcement. But the effectiveness of law enforce-

ment might be enhanced if either potential victims or law-enforcement officials—or both—had more education.

One interesting insight from the Ehrlich model is the possible explanation of racial and age differences in the incidence of illegal activities. Some studies have produced evidence that suggests a different rate of return to investment in formal schooling for white and nonwhite population groups; especially for males, the data seem to show that the rate of return to schooling is much less for nonwhites than for whites.[22] If the potential returns from participation in illegal activity were equal for both groups, a lower return from legal activities would tend to result in a higher incidence of participation in illegal activities for nonwhite males, other things being equal.

An empirical implication of this relationship is that the distribution by years of schooling of nonwhite males engaged in illegal activities ought to be different from the comparable distribution of white males, relative to the schooling distributions of those engaged in legal activities in both groups. Ehrlich provides some evidence that this in fact is the case. Among inmates of institutions in 1960 aged 25 to 34 the average schooling level of nonwhite males and females was slightly higher than that of white males and females; the corresponding statistics for experienced members of the labor force show exactly the reverse relationship—higher average schooling for white males and females than for nonwhites. However, these data relate only indirectly to arrest and conviction statistics and constitute only a relatively weak verification of the hypothesis.

The evidence on age distribution of offenders is much stronger and entirely consistent with the model. Here, Ehrlich finds that juveniles not enrolled in school show much higher delinquency rates than those enrolled in school. The model suggests that the rewards from (legal) labor force participation are much higher for those in school than for dropouts, since there is a substantial future earnings return from schooling. The relatively high unemployment rate among teenage dropouts tends to work in the same direction, since it lowers expected returns from legal activities but does not change expected returns from illegal ones.

One of the most striking results of the study, which offers strong

[22] See Welch (1967), Landes (1968), and Hanoch (1967).

support for the basic theoretical structure of the model, concerns the differential incidence of arrests for specific types of crimes, using states as the unit of observation. The model suggests that expectations of financial gain and forgone earnings from labor force participation ought to be strong determinants of crimes against property like robbery and embezzlement, where direct financial gain is a major consideration. Such factors ought to be of lesser or no importance in explaining differences in the incidence of crimes against persons, such as murder, rape, or aggravated assault. In regressions run across states, the predicted differences show up clearly: The potential gain and potential cost variables were consistently significant in explaining crimes against property, but were unimportant in explaining crimes against persons.

Finally, there is some evidence in the Ehrlich chapter to suggest that more effective law enforcement may be one of the indirect benefits of higher levels of educational attainment. In an empirical analysis of the effectiveness of law enforcement in preventing illegal activities—derived from a simultaneous equations model involving both the demand for illegal activities and the supply of law enforcement—the educational level of the community showed a significant and positive influence on the effectiveness of law enforcement in reducing the rate of criminal activity. This result might come about because higher educational levels lead potential victims to take more effective measures of self-protection, because higher educational levels are associated with greater community cooperation with law-enforcement bodies, or because the educational level of law-enforcement bodies themselves, other things being equal, results in greater effectiveness per dollar spent.

The impact of educational attainment on reducing criminal activities via more effective law enforcement through any of the specified channels and the finding in the next chapter by Michael concerning the greater tendency of more highly educated families to adopt technical innovations earlier and more rapidly than other groups constitute two specific and important instances of the effects of educational attainment which are nonmonetary and which accrue partly to society as a whole rather than only to those being educated.

"Education and Fertility," by Robert Michael, asks whether the educational level of parents has any net influence on the quantity and quality of their children. The model used by Michael specified that children provide a flow of services to parents that varies

directly with their number and quality and that parental demand for children is derived from the demand for child services in conjunction with the costs of limiting the quantity of children via contraception. Because having children involves sexual activity, which confers positive benefits on the household, decisions about the desired number of children in the household must take account of the costs of spacing or preventing births through the use of contraceptive devices. Thus the costs of avoiding children are nonnegative, and the observed number of children in completed families would be affected by the existence of any differential in these costs among families.

Economic factors like family income and the price of husband's and wife's time would of course have an impact on the optimum level of child services and thus on family size: most studies show slight but positive correlations between family income and number of children and negative correlations between the implicit price of the wife's time and number of children. Over and above these relatively straightforward but indirect influences of educational level, Michael asserts that the role of formal schooling might have an additional influence via its effect on the efficiency with which families practice contraception, rather than through its impact on income or the price of time. The argument rests on the relation between education and efficiency in processing information. Since a variety of contraceptive devices are available in the market and since innovation and technical changes have been relatively rapid in this area, it ought to be true that different levels of formal schooling result in a differential efficiency factor in "producing" children.[23]

Empirical tests of this model produce results consistent with the efficiency hypothesis. Standardizing for total income, husband's wage rate, and other demographic characteristics of the family, both the educational level of the husband and the relative (to the husband) educational level of the wife have a significant negative association with the number of children.

Additional evidence concerning the influence of the wife's education on the choice of contraceptive techniques and on the level of education expected for children supports the notion that educa-

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[23] That test may have more power to explain behavior in the past than in the future. The diffusion of technical knowledge about contraceptives has been very rapid, and it is not clear that large differences among groups classified by income or education still exist.

tion may influence fertility through a number of different chan-
nels—income, the price of time, contraceptive efficacy, and per-
haps the incentive to invest in human capital in children. As
Michael stresses, the results reported in his paper are preliminary
and do not represent completed research. They serve to indicate
the diversity of ways in which education appears to influence this
important aspect of behavior.

The final chapter in this volume, "The Influence of Education and
Ability on Salary and Attitudes," by Albert Beaton, focuses on the
relation between educational attainment, basic ability as measured
by IQ, and a variety of economic, social, and political attitudes. The
relation between earnings and the attitude variables, and between
ability and educational attainment, is also examined. The analysis
in Beaton's chapter is based entirely on the NBER-TH sample of
Air Crew veterans, which has provided the empirical base for a
number of the other chapters in this book.

The strong positive association between ability levels and edu-
cational attainment is thoroughly documented, as is the equally
strong positive association between educational attainment and
earnings (given ability) and between ability and earnings (given
educational attainment). Beaton also documents the positive asso-
ciation between business or professional self-employment and
earnings for given educational attainment and ability classes.

One of the most interesting sets of results concerns the relation
between nonpecuniary aspects of the employment situation and
money earnings. Respondents were asked several questions about
attitudes toward their jobs: whether they regarded them as inter-
esting, challenging, enjoyable, etc. In general, these are aspects
of jobs to which positive monetary equivalents would be attached;
one could, for example, use a measure of job interest or challenge
to represent nonmonetary consumption benefits from work, a type
of benefit conceptually similar to the nonmonetary benefits that
people enjoy from leisure-time activities. Theoretically, it would
be anticipated that the monetary compensation for any given job
is inversely related to the nonmonetary consumption benefits
associated with that job: an equivalent position that lacks the
nonmonetary benefit would presumably require higher monetary
earnings to induce people to take it.

The evidence from the NBER-TH sample indicates that non-
monetary job benefits such as enjoyment, interest, and challenge
are strongly and *positively* related to earnings; people who receive

relatively high money earnings also find their work situations more enjoyable, etc., and thus have more rather than less consumption benefits than others. The data also indicate that respondents with more education tend to regard their work as more challenging and interesting, and as holding a better chance for advancement, than the job situations of less well educated people, although educational level appears to be negatively associated with expectations about job responsibility. On the whole, the results suggest that the observed inequality of earnings would be increased if account were taken of the nonmonetary benefits of the work environment and that the returns to educational attainment are higher than suggested by analysis of the monetary returns because consumption benefits from work tend to be positively associated with the level of educational attainment. Thus the rate-of-return estimates in the Taubman-Wales chapter, for example, would tend to understate the true return to investments in higher education.

The social and political attitudes of respondents, as reported in self-rating on a liberal-conservative scale and in several attitude variables (whether young people have too much or too little freedom, whether people are overly concerned with financial security, and whether the pace of racial integration is too fast or too slow), tend to be generally conservative in this relatively high-income, heavily entrepreneurial, and almost entirely white sample of respondents. However, there is a consistent tendency for differences in educational attainment to move respondents toward the less-conservative end of the spectrum for most of the attitude questions. That is, respondents with more education were less likely to think that the pace of racial integration is too fast, less likely to think that young people have too much freedom, etc.

Ability measures also turned out to be associated with political attitudes. Here, the higher-ability groups were apt to be somewhat less conservative than others with respect to questions about the appropriate amount of freedom for young people or the appropriate pace of racial integration. Ability measures, on the other hand, tended to be associated with a greater tendency to rank oneself as politically conservative. Finally, the attitudes of the self-employed business proprietors in the sample were clearly much more on the conservative than the liberal side, whereas teachers and self-employed professionals tended to be on the liberal side of the scale. These results concerning the effects of education and ability on attitudes are of particular interest because they represent partial

correlations or net effects; that is, the effects of education are measured with the influence of ability and occupational status held constant.

Respondents were also asked a battery of questions about factors associated with success in particular jobs or professions. The results are what might be expected from a high-income sample of entrepreneurially oriented respondents: With virtual unanimity, respondents regarded "one's own performance" and "hard work" as the major factors associated with success, whereas being lucky or unlucky was considered unimportant. And there are some interesting relationships involving the influence of education and ability on the evaluation of factors important for career success. In general, the more able respondents tended to give low rank to the importance of "having the right connections," and they also indicated that ability to get along with people was relatively unimportant. In general, it appears that the most able respondents considered ability itself to be sufficient for occupational success, whereas other respondents considered other factors relatively more important.

The data show a very strong association between average earnings and the respondent's ranking of the relative importance of his own performance and hard work: those who ranked these factors as very important tended to have substantially higher salaries than others. One is tempted to regard these results as essentially ex post rationalization: those who have achieved success attribute it to their own hard work and ability and not to factors unrelated to their own inputs. However, other data indicate that financial success as measured by total earnings is positively associated with hours spent at work, which in turn argues that the findings might well be taken at face value.

The final set of variables measures the attitudes of sample respondents toward education itself. Questions deal with aspects of the educational process that the respondents felt to be relatively important or relatively unimportant. By an overwhelming majority, the sample considered the acquisition of basic skills to be the single most important function of the educational process, with career preparation next, followed by general knowledge. Activities and social awareness were regarded as relatively unimportant functions of schools.

Based on the responses to the schooling-importance variables, there is some indirect evidence in the pattern of average earnings

that suggests that general training rather than specific training entails higher economic productivity. Those who ranked general knowledge as more important had consistently higher salaries than those who ranked it as less important, whereas those who regarded career preparation as relatively unimportant tended to have higher average salaries than others. These results presumably reflect, in part, the heavily entrepreneurial nature of the sample, since career preparation would hardly be rated highly by independent entrepreneurs. One might, however, also expect career preparation to be highly rated by lawyers, doctors, and other professionals, who obviously must be trained for their future occupations in school, and this is not the case according to the data. In fact, the association between education in years and evaluation of the relative importance of general knowledge and career preparation is characterized by statistically (highly) significant signs: The higher the level of education, the more importance assigned to the general-knowledge function and the less importance assigned to the career-preparation function. And these are among the strongest relations involving educational attainment and any of the attitude variables.

This last set of results, although based on the subjective evaluation of men who are many years beyond the completion of formal schooling, has clear implications for educational policy. The data show that in a relatively successful, high-ability group of men at the peak of their career earnings profiles, those with more education regard the acquisition of general knowledge as a much more important (productive) function of schools than preparation for specific careers. These results are consistent with the well-documented fact that the majority of people end up in careers that have little direct relevance to their specific training in school.

SUMMARY Although the chapters in this volume cover a wide-ranging set of issues, a number of unifying themes can be traced out.

First is the firmly documented finding that investments in formal schooling apparently yield a "profit" both to the individual being educated and to society as a whole, after standardizing for the influence of innate ability and family background on earnings. Making no allowance at all for the fact that education provides some direct consumption benefits, or for the fact that there are likely to be substantial social and private returns other than those reflected by direct earnings differentials, the evidence suggests

that the lower limit on returns to higher education is in excess of borrowing costs.

A second major finding is that the payoff to formal schooling is not restricted to those with favorable family background factors or high ability. Although there is some evidence that those with very high ability get better-than-average returns from investing in formal schooling, the returns are substantial throughout at least the upper half of the ability distribution. Our best results come from a sample restricted to men with above-average ability, but even the lowest segment of that sample shows a significant return to investment in higher education. Thus it is not the case that education has no payoff except for those at very high ability levels.

A quite different kind of result, which shows up in many of the chapters in this volume, is that higher education apparently tends to enhance decision making generally. The probable explanation is that formal schooling increases information-processing skills. Thus in a world in which technical change is rapid and new situations are continually emerging, formal schooling yields a substantial benefit in enhancing the problem-solving capacity of those being educated. Another way to make the same point is to say that the returns to schooling are apparently greater in a world where change is relatively rapid than in one where change is relatively slow.

Finally, there is considerable evidence scattered throughout these chapters indicating that one of the ways in which education produces benefits is to stretch the time horizon for individual decisions and create a relatively stronger preference for the future as against the present. The evidence here is largely indirect, but it tends to show up consistently.

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