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EDUCATION AND INVESTMENT IN HUMAN CAPITAL

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I

AS TECHNOLOGICAL developments have altered production techniques, types of mechanical equipment, and varieties of outputs, society has begun to recognize that economic progress involves not only changes in machinery but also in men—not only expenditures on equipment but also on people. Investment in people makes it possible to take advantage of technical progress as well as to continue that progress. Improvements in health make investment in education more rewarding by extending life expectancy. Investment in education expands and extends knowledge, leading to advances which raise productivity and improve health. With investment in human capital and non-human capital both contributing to economic growth and welfare and in what is probably an interdependent manner, more attention should be paid to the adequacy of the level of expenditures on people.

The principal forms of direct investment in the productivity and well-being of people are: health, learning (both in school and on the job), and location (migration). Formal education and health constitute two large components of public and private spending in the United States. Private expenditures alone for hospital and physician services were over

\$18 billion in 1959, having risen from \$8.6 billion in 1950.² Public education expenditures rose to \$19.3 billion in 1960 from \$7.3 billion at the turn of the decade.³ Priced at cost, gross investment in education in the United States has risen from 9 per cent of gross physical investment in 1900 to 34 per cent in 1956.⁴

Investment in future productivity is occurring increasingly outside the private market and in intangible forms. Our traditional conception of investment as a private market phenomenon and only as tangible plant, machinery and equipment must give way to a broader concept which allows not only for government investment but also for intangible investment in the quality of human capital.

Most economic analysis of return from education has focused on the contribution of education to earning capacity (and, presumably, to production capacity). While this has been valuable, it is only part of the picture, and perhaps not even a large part. Even aside from market imperfections, which create inequalities between wage rates and marginal productivity, earnings are an incomplete measure of the productivity of education to the extent that production occurs outside the market. In addition, emphasis on incremental earnings attributable to

¹ The research reported herein was in part supported through the Cooperative Research Program of the Office of Education, United States Department of Health, Education, and Welfare. I would also like to acknowledge the helpful comments by Theodore W. Schultz, Richard Goode, W. Lee Hansen, Elbert Segelhorst, William Swift, and Donald Yett on earlier versions of this paper.

² United States Department of Health, Education and Welfare, *Health, Education and Welfare Trends, 1961* (Washington: Government Printing Office, 1961), p. 23.

³ *Ibid.*, p. 53.

⁴ T. W. Schultz, "Capital Formation by Education," *Journal of Political Economy*, December, 1960, p. 583.

education disregards external effects. Schooling benefits many persons other than the student. It benefits the student's future children, who will receive informal education in the home; and it benefits neighbors, who may be affected favorably by the social values developed in children by the schools and even by the quietness of the neighborhood while the schools are in session. Schooling benefits employers seeking a trained labor force; and it benefits the society at large by developing the basis for an informed electorate. Compulsory school attendance and public (rather than private) support for education in the United States both suggest that external economies from either the production or consumption of education are believed to be important.⁵

From the vantage point of one interested in Pareto optimal resource allocation, it is essential to consider all benefits from some action (as well as all costs). Whether the benefits (or costs) involve explicit financial payments, or whether they are internal to, or external from, a particular decision-maker is irrelevant.

In the private sector of the economy, private benefits from goods and services are reflected in consumer demand; assuming economic rationality, competition, and the absence of external effects, private producers will meet the demand in a socially optimum manner. But when goods and services either have significant external effects or are indivisible (in the sense that consumption by one person does not reduce consumption opportunities for others—as, for example, national defense), the private market is inadequate. If the public sector attempts to

provide the service, and if consumer sovereignty is to reign, the extent of consumer demand must be judged. Thus arises the need for benefit-cost analysis.

Within the benefit-cost framework this paper focuses principal attention on the ways by which a society benefits from formal education, discussing much more briefly some of the ways by which it incurs costs in providing education. It is worth emphasizing that analyzing benefits (or costs) does not preclude specifying which people reap the returns (or incur the costs). We shall attempt to identify the benefits of education by recognizing the beneficiaries of the education process.

In the discussion which follows, a "benefit" of education will refer to anything that pushes outward the utility-possibility function for the society. Included would be (1) anything which increases production possibilities, such as increased labor productivity; (2) anything which reduces costs and thereby makes resources available for more productive uses, such as increased employment opportunities, which may release resources from law enforcement by cutting crime rates; and (3) anything which increases welfare possibilities directly, such as development of public-spiritedness or social consciousness of one's neighbor. Anything which merely alters relative prices without affecting total utility opportunities for the group under consideration will not be deemed a social benefit (or loss). For example, if expanded education reduces the number of household servants, so that the wage rates of those remaining rise, this rise would not constitute either a benefit or loss from education but rather a financial transfer. Without making interpersonal utility comparisons we cannot say more. Of course, the increased productivity of those with

⁵ Similarly, but perhaps more clearly, compulsory smallpox vaccination together with public provision of vaccine reflects external economies of "consumption" of the vaccine.

the additional education is a benefit of type 1.

In addition to an analysis of the forms of education benefits and the nature of the beneficiaries, I shall investigate opportunities for quantifying these returns and some implications of the benefits analysis for the financing of education.⁶ In Section II, I shall consider benefits which the individual receives in the form of market opportunities—including additional earnings resulting from increased productivity and benefits which the individual receives in ways other than earnings. In Section III, I shall consider benefits which the individual does not capture but which accrue to other persons. Benefits from elementary, secondary, and higher education will receive attention.

II

In this section we examine those benefits of education (or returns from education) which are realized directly by the student. One form of such benefits is the "financial return" accompanying additional education. A second form is the "financial option" return. Previously unconsidered, this benefit involves the value of the opportunity to obtain still further education. Third are the non-monetary "opportunity options," involving the broadened individual employment choices which education permits; fourth are the opportunities for "hedging" against the vicissitudes of technological change. And fifth are the non-market benefits.

⁶ While I shall refer throughout this paper to the research of others I should like to mention particularly the excellent survey recently completed by Alice M. Rivlin; see her "Research in the Economics of Higher Education: Progress and Problems," in Selma J. Mushkin (ed.), *Economics of Higher Education* (hereinafter cited as "*Higher Education*") (Washington: United States Department of Health, Education, and Welfare [forthcoming]).

DIRECT FINANCIAL RETURN

Census Bureau data relating level of earnings to level of educational attainment show an unmistakable positive correlation. A number of investigators have estimated the percentage return from investment in education by attributing these observed earnings differentials to education.⁷ Some have attempted to adjust for or, at least, to recognize factors other than education which affect earnings and which are positively correlated with level of education. These include intelligence, ambition, informal education in the home, number of hours worked, family wealth, and social mobility. One factor which I believe has not been considered is that a positive correlation of educational attainment with family wealth suggests that those with more education may live longer and consequently tend to receive greater lifetime incomes, education aside, although it is true that longer life is not synonymous with longer working life. We are led to the presumption that, in general, persons who have obtained more education would have greater earnings than persons with less education, even without the additional schooling.⁸ At the same time, at least one study has attempted to isolate some of the non-education variables affecting earnings, with the finding that median salaries rose with additional

⁷ On the relation between educational attainment and earnings see G. Becker, "Underinvestment in College Education?" *American Economic Review, Proceedings*, May, 1960, pp. 346-54; H. S. Houthakker, "Education and Income," *Review of Economics and Statistics*, February, 1959, pp. 24-28; H. P. Miller, "Annual and Lifetime Income in Relation to Education," *American Economic Review*, December, 1960, pp. 962-86; E. F. Renshaw, "Estimating the Returns to Education," *Review of Economics and Statistics*, August, 1960, pp. 318-24.

⁸ See D. S. Bridgman, "Problems in Estimating the Monetary Value of College Education," *Review of Economics and Statistics, Supplement*, August, 1960, p. 181.

amounts of post-high-school education, even after adjustments were made for (1) level of high-school class rank, (2) intelligence-test scores, and (3) father's occupation.⁹ Apparently at least part of the additional earnings of the more educated population are the results of their education.

Although earning differentials attributable to education may be of considerable significance to the recipients, the social significance depends upon the relationship between earnings and marginal productivities. However, we know that market imperfections may make earnings a poor measure of one's contribution to output and that in a growing economy cross-section age-earnings data will understate future earnings. Mary Jean Bowman has suggested that older workers may receive more than their marginal productivity because status and seniority rules may maintain income although their productivity is falling.¹⁰ But even assuming that earnings equal current marginal productivity, estimation of lifetime productivity from cross-section earnings data tends to understate future productivity of today's young men; this is true because in a growing society each new cohort of people into the labor force comes with better education and knowledge. These two examples suggest that the observed current earnings of men are less than fully satisfactory as reflections of future marginal productivity. Much work remains before we can feel confident of our ability

⁹ Dael Wolfe, "Economics and Educational Values," *Review of Economics and Statistics, Supplement*, August, 1960, pp. 178-79. See also his *America's Resources of Specialized Talent* (New York, Harper & Bros., 1954); and Wolfe and Joseph G. Smith, "The Occupational Value of Education for Superior High School Graduates," *Journal of Higher Education*, 1956, pp. 201-13.

¹⁰ "Human Capital: Concepts and Measures," in Mushkin (ed.), *Higher Education*.

to measure adequately the productivity return to education. Perhaps more serious, because apparently it has not been recognized, is a methodological limitation to previous estimates of the financial return to education.

FINANCIAL OPTION RETURN

Given our interest in resource allocation, we should like to know what financial return from additional education a person can expect. I suggested above that earnings differentials associated with education-attainment differentials would have to be adjusted for differences in ability, ambition, and other variables before we could isolate the education effects; and that an adjustment for systematic differences between earnings and productivity would also be required. Let us assume that these adjustments have been made and that we have computed the present values of expected future earnings of an average person with J and with K years of education, *ceteris paribus*; it is my contention that this would be an erroneously low estimate of the gross return which may be expected from the additional education. The value of the additional education may be thought of as having two components: (a) the additional earnings resulting from completion of a given level of education (properly discounted to the present, of course) and (b) the value of the "option" to obtain still further education and the rewards accompanying it. It is (b) which I wish to elaborate upon here.

In formula (1) below, the first term represents the rate of return over cost for education unit j , as computed in the usual manner; it is the difference between the present value of expected future earnings of a person who has attained, but not exceeded, level j , and the present value of expected future earnings

of a person without education j , as a percentage of the additional cost of obtaining j . This is the rate of return as computed heretofore.

Subsequent terms in the formula measure the option value of completing j and should be understood as follows: each of the R^* are rates of return on incremental education α , computed in the manner described in the paragraph above. \bar{R} is the opportunity cost of expenditure on education in terms of the percentage return obtainable from the next best investment opportunity, so that $R_\alpha^* - \bar{R}$ indicates any "supernormal" percentage return. C_α = the marginal social cost of obtaining the incremental education α (where each cost ratio, C_α/C_j , is a weighting factor, permitting the percentage returns on the costs of various levels of education to be added), and P_α is the probability that a person who has attained level j will go on to various higher levels.

$$\begin{aligned}
 R_j = & R_j^* + (R_k^* - \bar{R}) \frac{C_k}{C_j} \cdot P_k \\
 & + (R_l^* - \bar{R}) \frac{C_l}{C_j} \cdot P_l + \dots \\
 & + (R_z^* - \bar{R}) \frac{C_z}{C_j} \cdot P_z = R_j^* \\
 & + \sum_{\alpha=k}^z (R_\alpha^* - \bar{R}) \frac{C_\alpha}{C_j} \cdot P_\alpha.
 \end{aligned} \tag{1}$$

Thus, for example, a decision to obtain a high-school education involves not only the likelihood of obtaining the additional earnings typically realized by a high-school graduate but also involves the value of the opportunity to pursue a college education.¹¹ The value of the option to obtain additional education will tend to be greater the more elementary the education. For the "highest" level of formal education, the value of

the option is clearly zero,¹² except insofar as the education provides the option to pursue independent work.

The option-value approach attributes to investment in one level of schooling a portion of the additional return over cost which can be obtained from further education—specifically, that portion which is in excess of the opportunity cost rate of return. Although part of the return from college education is indeed attributed to high-school education, there is no double-counting involved. In fact, the procedure is the same as that involved in the valuation of any asset, where the decision to retain or discard it may be made at various times in the life of the asset. Consider the following case: a machine is offered for sale. The seller, anxious to make the sale, offers an inducement to the buyer in the form of a discount on the purchase of a replacement machine when the present one wears out. Analyzing the prospective buyer's current decision, we see that he is being offered a combination of (1) a machine now, and (2) a discount (or option) "ticket" for possible future use. Both may have value, and both should be considered by the prospective buyer.

Let us assume that the machine has been purchased and used, and the owner is now deciding whether he should buy a replacement. Needless to say, the rate

¹¹ Research by Jacob Mincer suggests that additional schooling also provides opportunities to obtain additional on-the-job training (see his "On-the-Job Training: Costs, Returns, and Some Implications," Table 1, in this Supplement). The value of this opportunity should be included in the financial option approach developed here.

¹² Thus, for estimating the return from college or graduate education, omission of the value of the option may not be quantitatively significant. At the same time, since the return from higher education as previously estimated seems to be close to the return on business investments, recognition of the value of the option might tip the balance.

of return expected from the prospective machine will be a function of its cost net of the discount. The profit-maximizing buyer will compare the rate of return on the net cost and compare it with the opportunity cost of capital. Thus, in a real sense, the discount ticket has entered into two decisions: to buy the original machine and to buy the replacement. But this is not equivalent to any erroneous double-counting.

The machine discount-ticket analogy also makes clear the point that the value of the option (or discount) cannot be negative. If a greater rate of return (or discount) is available elsewhere, the value of the option merely becomes zero, as long as it need not be used. Thus, as long as a high-school graduate need not go on to college the value of the option to go on cannot be negative. It is formally conceivable, however, that a positive option value of elementary-school education could consist of a negative value for the high-school component and a larger, positive value for the college component.

Formula (1) indicates that the value of the option to pursue additional schooling depends upon (1) the probability of its being exercised and (2) the expected value if exercised. Without further information, factor 1 may be estimated by the proportion of persons completing a particular level of education who go on to a higher level. The expected value of the option if exercised, factor 2, is any excess of the return on that increment of education over the return obtainable on the best comparable alternative investment, where the latter may be assumed to equal, say, 5 per cent. Actually, the "excess" returns should be discounted back to the decision date from the time the higher education level would begin, but to illustrate the point simply

I shall disregard this, at least to begin with.

According to some recent estimates reported elsewhere, the return to the individual on total high-school costs (including foregone earnings) for white urban males in 1939¹³ was approximately 14 per cent and the return on college costs for those who graduated was estimated at 9 per cent.¹⁴ We might assume the return to be somewhat lower—say, 8 per cent—for those who did not complete their college training.¹⁵ Then with approximately 44 per cent of high-school male graduates beginning college and 24 per cent graduating,¹⁶ the a priori expected return on a social investment in high-school education in 1939 was, substituting in equation (1) above, 17.4 per cent, as shown in equation (2) (see bottom of following page).

To reiterate, the first term, 14, is the estimated percentage return to high-school education. In subsequent terms,

¹³ T. W. Schultz, "Education and Economic Growth," *Social Forces Influencing American Education* (hereinafter cited as "Economic Growth") (Chicago: National Society for the Study of Education, 1961), chap. iii, referring to G. S. Becker's work. H. H. Villard has seriously disagreed with these estimates. See his "Discussion" of Becker's "Underinvestment in College Education?" in *American Economic Review, Proceedings*, May, 1960, pp. 375-78. See also W. L. Hansen, "Rate of Return on Human versus Non-human Investment" (draft paper, October, 1960).

¹⁴ Schultz, "Economic Growth," p. 78.

¹⁵ While this paper deals with education benefits, quantitative comparison of benefits with costs are made to help assess the relative magnitudes of benefits. In doing this I do not intend to imply complete satisfaction with the cost estimates. The appendix of this paper presents some of the issues involved in defining and measuring social costs.

¹⁶ Computed from 1960 data for males of ages 25-29, in United States Bureau of the Census, *Current Population Reports: Population Characteristics, Projections of Educational Attainments in the United States, 1960-1980* (hereinafter cited as "Educational Attainments") (Series P-20, No. 91 [January 12, 1959, p. 8, Table 2]).

the first element is an estimate of the return in excess of alternatives, obtainable on additional education; the second element is the total cost of the additional education as a proportion of the cost of high-school education;¹⁷ the third element is the proportion of high-school graduates who obtain the additional education. If the returns to college education were discounted back four years to the date at which high-school education was initiated, at a 5 per cent discount rate the expected return to high-school education would drop to $14 + 2.1 + 0.7 = 16.8$, instead of 17.4 per cent.

In the example above it was assumed that a decision to complete high school would be realized with certainty. Other assumptions could be fitted easily into the framework. And if knowledge existed regarding the prospective high-school student's college plans, then *average* probabilities of his continuation should not be used.

If the option value of education has been overlooked by parents as it has been by economists there would be a tendency toward underinvestment in education. If time horizons are short so that, for example, a prospective high-school student and his parents sometimes fail to consider that a few years later the child may wish he could be going on to college, there will be a sys-

¹⁷ Computed from data in Schultz, "Economic Growth," p. 79.

$$\begin{array}{ccccccc}
 \text{High-School} & & & & & & \text{Some College} \\
 \text{Graduates} & & \text{College Graduates} & & \text{(Assumed = 2 years)} & & \\
 14 & + & (9-5) (2.70) (.24) & + & (8-5) (1.35) (.20) & & \\
 & & & & & & \\
 & & & & & & (2) \\
 & & & & & & = 14 + 2.6 + 0.8 = 17.4 \text{ per cent .}
 \end{array}$$

$$\begin{array}{ccccccc}
 \text{Grade-School} & & & & & & \text{Some College} \\
 \text{Graduates} & & \text{High-School Graduates} & & \text{College Graduates} & & \text{(Assumed = ? Years)} \\
 35 & + & (14-5) (2.3) (.67) & + & (9-5) (6.3) (.16) & + & (8-5) (3.1) (.13) \\
 & & & & & & \\
 & & & & & & (3) \\
 & & & & & & = 35 + 13.9 + 3.8 + 1.2 = 53.9 \text{ per cent .}
 \end{array}$$

tematic downward bias to the valuation of education by individuals. Even disregarding graduate education, the option value of high-school education increased the rate of return on high-school costs from 14 to 17 per cent, considering only the "monetary" returns. For grade-school education, recognition of the value of the option to obtain additional education increases the expected 1939 return even more substantially above the previous estimate of 35 per cent¹⁸ (see eq. [3] at foot of page).

The option turns out to be quite valuable indeed, increasing the return on elementary education from 35 to 54 per cent. It could be argued in this case that whether the return is 35 per cent or 54 per cent¹⁹ is relatively immaterial for

¹⁸ Again disregarding the discounting. The 35 per cent estimate is from Schultz, "Economic Growth," p. 81. Relative costs were estimated from the same source (p. 79), except that Schultz's elementary-school cost figure was doubled, since it applied to only four years of school. The proportions of children continuing on to higher education were estimated from *Educational Attainments*, p. 8.

In this paper I do not discuss any option value for college education; however, there may be a positive option value related to opportunities for graduate study and additional on-the-job training.

¹⁹ Previous estimates of rates of return represented a discounting of costs and returns back to the beginning of that particular level of schooling; since our time benchmark is the beginning of grade school, the values of the high-school and college options should be discounted back to the beginning of grade school. Doing so, at a discount rate of 5 per cent, reduces the 54 per cent return to $35 + 9.5 + 2.1 + 0.7 = 47.3$. The return would almost certainly be larger if persons obtaining only some high-school education were considered.

policy purposes, both being considerably greater than available alternatives. However, given the state of our confidence in the previously computed rates of return, it is comforting to see the estimates moved further from the decision-making margin. Of course, in addition to these returns, assuming they are attributable solely to education, are the non-market returns to education, including the direct consumption value of learning and the opportunity to lead the "full life."

NON-FINANCIAL OPTIONS

The words "option" and "opportunity" have appeared in the discussion above a number of times. Indeed, it seems that in many respects the value of education is a function of the additional options which became available to a person having it—job options, income-leisure-security options, additional-schooling options, on-the-job learning options, way-of-life options.

Recognizing the existence of such options suggests a possible means of estimating the monetary equivalent value of non-monetary returns from education. Thus, the college graduate who chooses to go to graduate school and then enter academic life may be assumed to obtain a total (not merely monetary) return on his graduate education costs at least equal to what he could have obtained from a comparable alternative investment. In general, added education permits widened job choices, and to some extent people with more education will choose employment which provides non-monetary rewards (for example, greater security) at the expense of monetary rewards. To the extent that this is correct and that knowledge of alternatives exists, previous estimates of the individual returns to education, utilizing incremental earnings figures for people with two dif-

ferent levels of education, have had a downward bias. If monetary returns from, say, graduate education turn out to be less than comparable alternative returns, the difference would be a minimum measure of non-monetary returns, though not necessarily of the employment-associated return alone.

"HEDGING" OPTION

There is another respect in which education provides a person with options: the increased ability to adjust to changing job opportunities. With a rapid pace of technological change, adaptability (which may be a noteworthy output of additional education) becomes important. Education may be viewed as a type of private (and social) hedge against technological displacement of skills. New technology often requires new skills and knowledge;²⁰ and those persons having more education are likely to be in a position to adjust more easily than those with less education, and to reap the returns from education which the new technology has made possible. This line of reasoning suggests that a more general academic curriculum is desirable since it permits greater flexibility than a curriculum which requires earlier specialization.

Insofar as the return resulting from greater flexibility is realized in the form of earnings, it will be reflected directly in the estimated monetary value of education. The hedging option has additional value, however, to the extent that

²⁰ This view seems to be shared by H. Coombs, who states that "there will be many unpredictable shifts in the proportions needed of specific categories of . . . manpower. Thus, it will be important . . . to enlarge the total supply of high ability manpower available for all purposes" ("Some Economic Aspects of Educational Development," in International Association of Universities, *Some Economic Aspects of Educational Development in Europe* [Paris: International Universities Bureau, 1961], p. 78).

people have a preference for greater security and stability of earnings.

The hypothesis that added schooling develops added labor-force flexibility and thereby facilitates adjustments to changing skill requirements suggests the following implication: the greater the level of an individual's formal education attainment, the more he can benefit from additional on-the-job training, and, therefore, the more on-the-job training he will obtain. Jacob Mincer's data support this view;²¹ through time, investment in learning on the job is increasingly being concentrated on persons with education beyond elementary school. He estimates that in all three years, 1939, 1949, and 1958, on-the-job training costs per person were positively correlated with the level of education. Moreover, a trend is observable—in 1939, on-the-job training costs per person with elementary education were 38 per cent of costs per college-educated person; in 1949 they were 30 per cent; and by 1958, 28 per cent. Over the twenty-year period, training costs per capita for elementary-educated persons actually declined (in constant dollars), while they climbed 13 per cent for college-trained persons.

NON-MARKET RETURNS

So far we have discussed the return to education which is realized by the individual in terms of his employment conditions. But some of the value of education to the individual accrues in other forms. For example, the fruits of literacy—an output of elementary education—include, in addition to consumption aspects, the implicit value of its non-mar-

²¹ *Op. cit.*, Tables 1 and 2. But E. F. Renshaw predicts that the principal educational requirements of the 1960's, with respect to the labor force, will be directed toward trade schools and apprenticeship programs ("Investment in Human Capital" [unpublished manuscript, 1960], p. 13).

ket use. To illustrate: when a person prepares his own income tax return he performs a service made possible by his literacy. Were this service provided through the market, it would be priced and included in national income.²²

Assume that roughly fifty million of the sixty million personal income-tax returns filed per year are prepared by the taxpayer himself. At a value of \$5.00 per return, a low estimate of an average charge by an accountant for preparing a not-too-complex return, we arrive at an annual market value of the tax-return services performed by taxpayers for themselves of \$250 million. Relative to Schultz's estimate of total elementary-school costs of \$7.8 billion in 1956,²³ this suggests a current-year return of 3.2 per cent of the current investment in literacy! And this is only one, obviously

²² It could be argued that the service (like many others in national income and product) is not a final output, but a cost item (cost of tax collection), and thus should not be included in estimates of production; but since it is often difficult to distinguish clearly outputs from inputs in our national accounts, and since our national income and product accounts principally measure effort expended, it would be interesting to make some estimate of the market-value equivalent of the services performed by a person in preparing his own income-tax return.

Inclusion of the value of this non-market production as an educational benefit presupposes that this represents a net increase in the value of the individual's total non-market activities and that the opportunity cost of performing additional non-market production is essentially zero.

Richard Goode has suggested that, although the failure to consider non-market production leads to understatement of the return to education, "nevertheless, there seems to be little danger that this omission will lead to an undervaluation of educational benefits in comparing time periods, countries, and population groups with different amounts of formal education." He presents "the hypothesis that the greater the amount of formal education the greater the proportion of goods and services acquired through the market. If this is true, estimates based on money earnings or national income statistics may exaggerate the contribution of education to real income differentials or growth."

²³ "Economic Growth," p. 64, Table 5.

minor, form of return from literacy which the individual enjoys.

This attempt to place a value on a particular use of literacy is subject to at least the following criticism: were it not for the widespread literacy in this country we would probably not have the present type of income-tax system operating, and, therefore, we would adjust to illiteracy in a less costly way than having others (say, accountants) prepare tens of millions of returns. The adjustment might involve government tax assessments or a resort to another type of tax such as one on expenditures. This suggests that the literacy value estimate above is on the high side, in terms of the alternative tax collection cost in the absence of literacy.

I have attempted a very rough estimate of the alternative cost of collecting an alternative form of tax—a sales tax—which would not require such a literate population, in order to compare it with the collection cost of the income tax.²⁴ The assumption is that a principal reason for the relative tax-collection efficiency of the income tax is the work performed by the taxpayer in preparing his own return. For the year 1940, the all-states average cost of collecting state personal income taxes was \$1.50 per \$100 collected, while the comparable figure for the general sales taxes of states was \$2.00 per \$100 collected. In the same year, collection costs per \$100 of federal personal income tax were estimated at \$1.68,²⁵ while there was, of course, no federal sales tax.²⁶

²⁴ This disregards the different distributive effects of the two forms of tax.

²⁵ James W. Martain, "Costs of Tax Administration: Statistics of Public Expenses," *Bulletin of the National Tax Association*, February, 1944, pp. 132-47, as cited in Charles A. Benson, *The Economics of Public Education* (Boston, Houghton-Mifflin Co., 1961), p. 145.

In the absence of a superior alternative I have assumed that, as was true for the state tax-collection costs presented above, a federal sales tax would cost one-third more to collect than the federal personal income tax. Assuming the 1960 Internal Revenue Service estimate of collection costs, of approximately forty cents per \$100, to apply to the personal income tax, then a one-third increase in the cost of collecting \$50 billion (1959 individual income-tax receipts) would involve an additional \$66 million—approximately 0.8 per cent of elementary-school costs.²⁷

III

In this section we consider the benefits of education which are external to the student. If all the benefits of education accrued to the student, then, assuming utility-maximizing behavior and access to capital markets, there would be little reason for public concern about the adequacy of education expenditures—unless publicly supported education were an efficient way of altering the personal distribution of income in a desired way.

Income redistribution effects aside, it seems clear that access to the capital market is imperfect and also that a child, even at high-school or college age, is in a poor position to make sensible long-run decisions regarding the amount or type

²⁶ Estimation of collection costs is subject to the common difficulty of the allocation of joint costs; furthermore, we really know little about scale economies in tax collection, or about the difference in degree of enforcement of state and federal taxes, so that it is dangerous to apply state cost figures to the federal level.

²⁷ Actually we should note that a number of years of education is required to develop "literate" people but also that, once developed, they presumably retain the knowledge. Were we to take into account the number of tax returns an average person may be expected to file during his lifetime, a higher rate of return would appear.

of education, though advice from teachers, counselors, and parents may improve the decision. But these imperfections hardly appear to justify the massive public expenditures in support of education—more than \$19 billion in 1960, including capital outlays.²⁸ We are led to the position that, to understand why education is of public concern as well as to project demand for education and determine whether expanded education is warranted on allocative-efficiency grounds, we should pay more attention to identifying and quantifying external benefits of education.²⁹ This section of the paper suggests a framework for analyzing these benefits and considers opportunities for measurement.

As economists, our interest in external benefits is typically related to the question of whether all benefits (as well as costs) of some action are taken into account by the decision-maker. The issue is whether the benefits are or are not captured by the decision-maker, since the assumption of profit maximization has the implication that benefits will be recognized by the decision-maker if, but only if, he is able to obtain them. Insofar as parents and children make joint decisions on purchases of education, with none of them being a very expert, experienced buyer, those benefits which are less apparent and indirect are likely to be overlooked. Parents thinking of their children may even neglect the less direct benefits to themselves, discussed below. Moreover, benefits to non-family members are probably not considered at all.

In principle, the recipients of external benefits from some activity (for example, education) should be willing to subsidi-

²⁸ *Health, Education and Welfare Trends, 1961, op. cit.*, pp. 52, 53.

²⁹ It is true, however, that economies of scale (with respect to the number of students) would also be a sufficient explanation for the public interest in education.

dize the activity and, indeed, should seek to subsidize it. The voting mechanism and taxation provide the means for subsidization. Analysis of voting behavior may shed some light on the question whether external benefits are recognized and have an effect on decisions. But regardless whether or not subsidies are actually paid by “outsiders,” we need to identify and measure the magnitudes of external benefits to determine the rate of return on resources devoted to education.

Persons receiving external benefits from a student’s education may be divided into three broad groups, though the same people may be in more than one: (1) residence-related beneficiaries—those who benefit by virtue of some relationship between their place of residence and that of the subject; (2) employment-related beneficiaries—those who benefit by virtue of some employment relationship with the subject; (3) society in general.

RESIDENCE-RELATED BENEFICIARIES

Current family of the subject.—While the purpose of schooling is obviously education, the manner in which it is provided may result in incidental, and even accidental, by-products; in the case of elementary education, such a by-product is child care. Schools make it possible for mothers who would otherwise be supervising their youngsters to do other things. For those mothers who choose to work, we have an estimate of the productivity of the child-care services—their earnings. This rests on the assumption that the mothers would not work if a sitter had to be hired but do work when the child is in school. If mothers would make other child-care arrangements in the absence of schools, then a better measure of value than earnings obtained would be the cost of hiring a baby sitter

or making some alternative custodial arrangement.

In March, 1956, there were 3.5 million working mothers in the United States with children six to eleven years of age.³⁰ Assuming that as few as one million of these mothers would not work except for the schools (the others being willing to let their children stay with hired persons or simply care for themselves), and assuming \$2,000 as the earnings of each mother during the school year, the value of the child-care services of elementary school may be estimated as roughly \$2 billion per year.³¹ Estimating total resource costs (excluding capital outlays but including implicit interest and depreciation) of public and private elementary schools in 1956 at \$7.8 billion,³² we reach the startling conclusion that elementary-school support provided a return of 25 per cent of cost in the by-product form of child-care services, alone.³³ This disregards the value of these services to mothers who do not choose to work; since the value is certainly greater than zero, the total value of the child-care is even more than 25 per cent of cost.

The increased production from work-

ing mothers tends to offset the foregone production from students in school. Various writers have emphasized students' foregone earnings as a cost of education, and have debated its magnitude,³⁴ but have not considered the fact that some mothers' earnings are made possible by the fact that children forego earnings to remain in school.

Future family of the subject.—When the student reaches adulthood and becomes a parent, the children will benefit from his or her education by virtue of the informal education which the children receive in the home. The presence and relevance of such education is recognized, but to my knowledge no attempts to estimate its value have been made. If scores on achievement tests could be related to educational attainments of parents, adjusting for variation in students' ability, we might obtain some information about the extent of education in the home. This might be translated into equivalent years in school, to which a value, perhaps average cost, could be attributed.

If we think of the investment-consumption distinction as involving whether or not benefits accrue in the "present" (consumption) or in the "future" (investment), then education has an investment component in the form of these intergeneration benefits.³⁵ If we generalize

³⁴ See Appendix below.

³⁵ Schultz has also recognized this point: "The education of women . . . reduces the subsequent effective costs of education because of the critical role that mothers play in motivating their children to obtain an education and to perform well while they are attending school. Thus, if we could get at the factors underlying the perpetuation of education, it is likely that we would discover that the education of many persons not in the labor force contributes heavily to the effective perpetuation of the stock of education. To the extent that this is true, some part of the education not in the labor force contributes to this investment process" ("Economic Growth," pp. 74-75).

³⁰ United States Bureau of the Census, *Marital and Family Status of Workers: 1956* (Series P-50, No. 73 [April, 1957]), p. 11, Table 3.

³¹ For those mothers who would be willing to hire baby sitters, obtainable for, perhaps, \$1,000 per year, the value of the school child-care services is this alternative cost of \$1,000, instead of \$2,000. Of the 3.5 million working mothers with children six to eleven years old, approximately 1.5 million also had children twelve to seventeen. Some of the older children could conceivably care for the younger ones; but even considering the remaining 2 million, the assumption that one-half would not work except for the care provided by schools seems plausible and even conservative.

³² Schultz, "Economic Growth," p. 85.

³³ If working mothers employ housekeepers as substitutes and if they incur other additional costs in working (for example, transportation and additional clothes), these added costs should be deducted from the gross returns.

the conception of investment to include not only intertemporal benefits,³⁶ but also interpersonal benefits, then the child-care role of schools, discussed above, represents an investment in the productivity of mothers. Similarly, other interpersonal benefits examined below will constitute investment aspects of educational expenditures.

Neighbors.—As we consider more extended groups, beginning with the individual receiving the education and then his family (present and future), we come to his neighbors. Education affects them at least in the following ways: by inculcating acceptable social values and behavior norms in the community children and by providing children with alternatives to unsupervised activities which may have antisocial consequences. The second is essentially of short-period significance—during the time the child is of school age. The first effect is clearly of long-period consequence, following the student as he grows, and as he moves. As the student achieves adulthood, and as he migrates, the social values developed in part through his education continue to affect his “neighbors.”³⁷

The hypothesis that education does affect neighbors might be tested by studying voting behavior on school issues among non-parents. We might expect that their voting would be influenced by the extent to which students emigrate after completion of school, so that any potential external benefits or costs to neighbors would be realized by persons in other communities. Perhaps some notion of the magnitude of external, neigh-

borhood benefits—at least to the extent they are recognized—could be obtained in this manner.

Taxpayers.—Related to the effects of education on neighbors are the effects on those who pay (directly or indirectly) for the consequences of the lack of education. For example, insofar as lack of education leads to employment difficulties and crime, law enforcement costs will tend to be high. Thus may education provide social benefits by reducing the need for incurring these “avoidance costs,” to the advantage of taxpayers.

Education also benefits taxpayers in other communities. The migration of poorly educated persons having behavioral patterns and educational attainments differing from those prevailing in the new areas may necessitate additional effort and expense to permit the in-migrant children to adjust to the new school conditions.³⁸ Thus, people in areas of immigration have a stake in the education of children in the areas of out-migration. People who are or may be in the same fiscal unit with an individual have a financial stake in his education.

EMPLOYMENT-RELATED BENEFICIARIES

The education of one worker may have favorable external effects on the productivity of others. Where production involves the co-operative effort of workers, flexibility and adaptability of one worker will redound to the advantage of others. Productivity of each member of the group influences the productivity of each other member. In such a case, each worker has a financial interest in the education of his fellow workers. Again, the relevance of this interdependence for

³⁶ Tax implications of the existence of intertemporal education returns have been discussed by R. Goode, “Educational Expenditures and Income Tax,” in Mushkin (ed.), *Higher Education*.

³⁷ One writer points out: “Education has effects on the caliber of voluntary community activities: choral groups, drama, clubs, local art shows, etc.” (Benson, *op. cit.*, p. 349).

³⁸ See, for example, C. F. Schmid, V. A. Miller, and B. Abu-Laban, “Impact of Recent Negro Migration on Seattle Schools,” *International Population Conference Papers* (Vienna: Union Internationale pour l’Étude Scientifique de la Population, 1959), pp. 674–83.

the present context rests on the assumption that education develops the properties of flexibility and adaptability. Further analysis is required to determine the extent to which the assumption is valid, and if it is, to estimate its significance.

Employers may also have a financial interest in the schooling and training of their employees. Much of education improves the quality of the labor force and thereby bestows some benefits to employers of the workers insofar as market imperfections or the "specific"³⁹ nature of the education result in failure of the employer to pay the marginal revenue product of a worker.

SOCIETY IN GENERAL

Some of the benefits from education are enjoyed by individuals and groups that are reasonably identifiable, as we have seen. But some of the benefits are distributed broadly either spatially or temporarily, so that the nature of individual beneficiaries is obscure. These shall be considered under the heading, "Society in General," which thus becomes somewhat of a residual category of benefits.

Literacy is not only of value to the individual possessing it and to employers but also is of value to others. Without widespread literacy the significance of books, newspapers, and similar media for the transmission of information would dwindle; and it seems fair to say that the communication of information is of vital importance to the maintenance of

³⁹ As the term is used by Gary S. Becker "specific" training is that which raises the marginal productivity of the worker in one firm more than it raises his productivity in other firms. By contrast, "general" training raises marginal productivity equally in many firms. Since, under competitive conditions, wage rates are determined by workers' marginal productivities in other firms, a worker with "specific" training would be expected to receive a wage less than his actual marginal revenue productivity but more than his alternative productivity (see the paper by Becker in this Supplement).

competition and, indeed, to the existence of a market economy, as well as to the maintenance of political democracy.

Along the same lines it should be noted that the substantial role played by checking deposits in our economy requires, among other things, generalized literacy and competence with arithmetic operations. It is not necessary to argue the issue of cause versus effect, but only to recognize the essentiality of literacy—a principal output of elementary education—to the present state of our economic development. Nor does saying this deny the possibility that other factors were also indispensable to growth.

Equality of opportunity seems to be a frequently expressed social goal. Education plays a prominent role in discussions of this goal, since the financial and other obstacles to education confronted by some people are important barriers to its achievement.⁴⁰ If equality of opportunity is a social goal, then education pays social returns over and above the private returns to the recipients of the education.

Although the long-term effect of education on future earnings is surely the most powerful income distribution consequence of education,⁴¹ there are also some short-term effects. These occur through the provision by schools of things traditionally considered to be private consumer goods and services—including subsidized lunch programs, musical in-

⁴⁰ Even if it were true that educating everyone would widen the personal distribution of earnings compared with what it would be with less education, it would not follow that additional education for some people would worsen their relative or absolute economic position.

⁴¹ The relation between education and income distribution has been studied by J. Mincer ("Investment in Human Capital and Personal Income Distribution," *Journal of Political Economy*, August, 1958, pp. 281–302) and L. Soltow ("The Distribution of Income Related to Changes in the Distributions of Education, Age and Occupation," *Review of Economics and Statistics*, November, 1960, pp. 450–53).

strument lessons, and driver-training courses.

Earlier we distinguished between the output of education in the form of the student's training and the output of the system or means by which the training was accomplished—the latter being illustrated by custodial or child-care services. The same distinction may be made with respect to higher education, the point being that the training of students is not the only output of schools; a joint product is the research activity of college and university faculties, from which society reaps benefits. It is undoubtedly true that were it not for the higher-education system the volume of basic research would be smaller. A question exists regarding the extent to which the value of the research is reflected in salaries and, thereby, in private returns. The relation of education to research and of research to social returns deserves more attention from economists.⁴²

Training of persons in particular kinds of skills may result in important external benefits if there are bottlenecks to economic development. In the context of underdeveloped economies, one writer, while particularly noting the political significance of primary and higher education, and the prestige significance of the latter, argues: "Secondary education is essential to the training of 'medium' personnel (elementary teachers, monitors, officials, middle classes). The shortage of such people is today a real obstacle to economic development."⁴³ But without perfect capital markets and appro-

priate subsidization programs, these socially valuable people may be unable to capture for themselves the full value of their contribution. Therefore, their earnings would understate the full benefits of their education.

IV

In the preceding pages I have asked: "Who receive the benefits from education?" In addition, I have considered some of the limited possibilities for quantifying certain of the benefits. As plans are developed for future research I urge that more attention be directed to the spatial and temporal dimensions of these benefits.

While much work remains, we might summarize our findings. We have noted that some of the benefits of education are realized at the time the education is being received (that is, in the "short" run); others, after the formal education has been completed (that is, in the "long" run). Benefits to mothers, in terms of the child-care role of schools, and benefits to neighbors, in keeping children "off the streets" are realized while the education is being obtained. Any benefits associated with subsequent employment of the student as well as benefits to the student's future children are realized later.

We have found, further, that benefits from education occur not only at various times but also in various places. The benefits of education do not necessarily accrue to people in the area or in the school district which financed the child's education. In particular, some of the benefits depend upon the individual's place of residence, which may change. Location of many residence-related benefits as well as employment-related benefits will be determined partly by population migration, though this is not generally true of denefits to family members

⁴² For an interesting study of returns from research see Z. Griliches, "Research Costs and Social Returns: Hybrid Corn and Related Innovations," *Journal of Political Economy*, October, 1958, pp. 419-31.

⁴³ Micheal Debeauvals, "Economic Problems of Education in the Underdeveloped Countries," in International Association of Universities, *op. cit.*, pp. 116-17.

and to society as a whole. While it is not necessarily true that total benefits will depend upon one's location, the point is that the particular beneficiaries will be a function of the location of the individual. Thus, the process of migration is a process of spatial shifting of some of the external effects of education.

Some interesting questions are raised simply by the recognition that external benefits of education exist, and that they are not all in broad, amorphous form; that is, that to some extent these benefits accrue to particular, rather well-defined, groups. Thus, to the extent that the education system at the elementary level is producing child-care services as an output, benefit-principle taxation would suggest that families of the children might pay for these benefits.⁴⁴ In general, a desire to use this taxation principle would imply attempts to identify various groups of education beneficiaries and to assess taxes in recognition of the distribution of benefits.⁴⁵

It seems to me that there is a legitimate question concerning the justice of requiring broad, public support for education insofar as the benefits are narrow and private, except as an income-redistributive device. For example, to the extent that there is really no educational sacrifice involved in having children attend split-shift classes, so that the real motive for the abolition of split-shifts is to make life more comfortable for mothers who have all of their children in school at the same time, then a question of equity arises: should non-parents be expected to share the costs associated with the provision of these child-care services for parents? The answer may not be an un-

equivocal "no," but the question deserves further consideration. Except for lack of information, or a disavowal of benefit-principle taxation, there is little rationale for failure of our education-tax system to recognize the existence of particular groups of beneficiaries.

There is another strong reason in addition to the alleged justice of benefit-principle taxation for identifying benefits and beneficiaries. To the extent that the distribution of tax burdens for the support of education differs substantially from the distribution of education benefits, it is likely that education will be either undersupported or oversupported from an allocative-efficiency standpoint, given the existing preference structure and distribution of income and wealth.⁴⁶

Both with respect to equity and to efficiency in education finance, the increasing phenomenon of migration needs to be recognized. Insofar as some of the benefits of education depend upon the location of the individual and insofar as this location is a variable over his lifetime, some of the benefits from education accrue to people who have played no part at all in the financing of this particular person's education. This would seem to be especially pertinent with respect to areas of substantial net in- or out-migration. Areas experiencing net in-migration might be expected, on benefit-principle grounds, to subsidize areas of net out-migration, particularly if highly productive people are involved. Subsidy in the opposite direction might be justified insofar as the in-migrants to an area are relatively unproductive compared to its out-migrants. Needless to say, there are good and powerful arguments in favor of keeping all the financing of education at a local level. However, a thorough analysis of the issue would

⁴⁴ This point came out in a discussion with Julius Margolis.

⁴⁵ This is not to argue that the benefit principle, in contrast to the ability-to-pay or some other principle, should necessarily prevail.

⁴⁶ However, an objective of education may be to change the distribution.

seem to require recognition of the points raised here.

The analytic approach to benefit identification employed in this paper is one of many alternatives; it does appear to have the advantage of focusing on the time and the location of education benefits, and these are relevant to the study both of efficiency in the allocation of resources between education and other ends and of equity in the financing of education.

It is clear that even with much additional effort we shall be unable to measure all the relevant benefits of education. At the same time the following four points are worth noting, and they summarize the views expressed in this paper: (1) identification of benefits is the

logical step prior to measurement and, therefore, recognizing the forms of benefits represents some progress; (2) determination of what it is we are trying to measure will make it easier to develop useful quantification methods; (3) some reasonable measures of some education benefits are possible; (4) even partial measurement may disclose benefits sufficiently sizable to indicate a profitable investment, so that consideration of the non-measured benefits would, a fortiori, support the expenditure decision.

In any event, and however difficult the measurement task is, it remains true that education expenditure decisions will be made, and they will be made on the basis of whatever information is available.

APPENDIX: COSTS OF EDUCATION

The objective here is to consider briefly, at the conceptual level, some of the issues involved in estimating costs of education. There is no doubt that a complete picture of the cost of education would include all foregone opportunities, whether or not reflected by actual expenditures. Thus, the attempt to measure foregone production by looking at foregone earnings of students in school is fully appropriate. There is, of course, the difficult question of how to estimate the foregone earnings—in particular, whether they may be estimated by looking at the earnings of people of comparable age and sex who were not in school.

One of the issues is whether those in school are not, in general, more able and ambitious, so that their opportunity cost of schooling exceeds the earnings by their “drop-out” counterparts. Another involves the effect on earnings (actually, on the value of marginal productivity) of a large influx to the labor market, such as would occur if all college, or all high-school, students entered the labor force.

But it seems to me that this latter issue is beside the point. Studies involving cost and benefits of education are surely not

directed to the question whether there should or should not be education. Rather the issue is the profitability or productivity of reasonably small increments or decrements to education. The issue is whether fewer or more people should be encouraged to go further in school. Only marginal changes are being contemplated.

Still on the subject of estimating foregone production among students by estimating foregone earnings, there is the additional question of the validity of using earnings of employed people when there is a question whether resources released from the schools would or would not find employment. Thus, the view is not uncommon that measuring foregone earnings of students by the earnings of presently employed people is satisfactory only if there is little unemployment.⁴⁷ This question arises frequently, especially when public investment is being considered. Thus, it inevitably arises when the economic efficiency of public health expenditures is being discussed; would the additional labor resources made available by an improvement in public health be able to find employment? And with regard to

⁴⁷ See, for example, Rivlin, *op. cit.*, p. 12.

education, would labor resources released from schools be able to find employment?

It seems to me to be analytically unwise to mix study of the allocative efficiency of additional expenditures on education with study of the efficiency of monetary and fiscal policy in maintaining full employment. I would like to urge that in looking at the question of whether to invest more in education, we consider what students could earn and produce, not what they might actually earn or produce, as affected by unemployment. The efficiency of educational expenditures in dealing with unemployment is a quite different question from the efficiency of education as an allocation problem. Although there might be short-run transitional unemployment associated with some movement of students into the labor force, the basic issue of investment in people through education is of the long run.⁴⁸

The alternative production foregone because of education also involves the government services used by educational institutions. Since many of these services are rendered without charge to the schools, they are generally, and mistakenly, omitted from discussion of costs. Recognition by R. C. Blitz of the relevance of these services to estimation of education costs is a valid and important point.⁴⁹ However, estimating the social cost of these services as equal to the value of the property and sales taxes which the schools would have paid had they not been exempt is conceptually inappropriate (albeit perhaps pragmatically reasonable). To the extent that the services

rendered to schools by governments are “pure public services,” the actual marginal cost of providing these services to the school is zero. The essence of “pure” public services is that everyone may enjoy them in common, and the consumption by one person does not subtract from the amount available to others. For example, it is not at all clear how much additional police or fire services will be required in a community by virtue of the fact that there is a school within its limits.

At the same time, services performed by governments are never entirely of a “pure public service” nature—particularly in the long run (for example, public libraries, which are frequently used by students)—so the marginal cost of providing them to a school will, in general, exceed zero. But the marginal cost is likely to be below average cost and, therefore, to be below the estimated foregone property and sales taxes, which are related to average costs of providing public services.

Since social costs represent alternatives foregone, it is certainly not correct to include among the costs of education costs which would have been incurred anyway; therefore, all the food, shelter, and clothing costs of students while they are at school should not be considered a cost of education.⁵⁰ At the same time, if any of these maintenance costs are higher for students than they would be were the children not in school, then these additional costs are justifiably charged against the education process. If additional clothing, laundry, and transportation costs are incurred by virtue of a person being a student, these incremental costs are quite relevant to the issue of the productivity of investment in education. Such cost may be particularly high for college students living away from home, though they may not equal zero for college students living at home, or for elementary- or high-school students.

⁴⁸ Mary Jean Bowman shares this view: “Such validity, if any, as may attach to it [the view that marginal social opportunity costs of education are zero when unemployment is serious] is in any case limited to short term marginal valuations, whereas we are interested in long-term averages and aggregates. When long-term aggregate human capital formation is the focus, social opportunity costs are not zero even with chronic unemployment” (“Human Capital: Concepts and Measures,” in Mushkin [ed.], *Higher Education*).

⁴⁹ “The Nation’s Education Outlay,” in Mushkin (ed.), *Higher Education*.

⁵⁰ See discussion by Rivlin, *loc. cit.*, pp. 11–12, correctly criticizing the study by Harold F. Clark and Ruth E. Sobokov for including them.