Faculty Working Papers

TOWARD A THEORY OF EDUCATIONAL FINANCE

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Summary:

This paper developes a theory of educational finance that seeks to offer a logical framework for increased efficiency and equity in education, as well as a framework for integrating the 16 new research papers to which it serves as an introduction. It developes an hierarchy of efficiency criteria, and an hiearchy of equity criteria, followed by a step toward combining these efficiency and equit aspects into what are called humane growth criteria which are more directly releva to educational policy budget decisions. The contribution of education to humane growth is developed in this paper as including growth in per capita earnings and the standard of living, but as also including nonmonetary private and social retu to education plus a measure of the contribution of education to intergenerational distributive justice.

Toward a Theory of Educational Finance

Walter W. McMahon*

This book addresses major new issues arising in efficiency and equity in educational finance that have implications for research and for educational policy in the next decade. Original contributions by a number of distinguished economists and educators develop different aspects of efficiency and equity, their findings and the interaction that results provide an overview of the state of the art and suggest insights relevant to new research and to emerging national problems.

The need for a coherent conceptual framework is apparent, and therefore will be presented in this introductory chapter. The chapter seeks to go a bit beyond that, and develop a theory of educational finance that is relevant to policy decisions by considering efficiency and equity criterion and how they can be combined. The chapters that follow develop various aspects that relate to this conceptual framework, each with originality and in depth. The final chapter draws together the main conclusions of each of the preceding authors, and considers the progress that has been made.

Inefficiency and inequity permeate much of elementary, secondary, and college education currently. For example, many children are not learning the basics of reading, writing, and mathematics effeciently, many college students do not invest sufficient amounts of their own time in study, and pupil time and other resources are used inefficiently in other ways. With respect to equity, the continuing persistence of vast inequality in expenditures per child both within states and among states stands as mute testimony to the continuing

inequality of educational opportunity. The returns to education are, at the same time, vital to our society and important to each individual. Finding ways to maintain and to increase these returns and the equity with which they are distributed in a period of budget stringency, due to inflation, enrollment declines, and tax pressures faced by all of education are important to find. These problems suggest the need for further development of a logically consistent theory of educational finance to aid in isolating inefficiencies and inequities in specific educational budget and financing decisions. Furthermore, it is frequently true that advances in the theory facilitate measurement, later, of the relevant concepts, and also suggest new hypotheses that stimulate new empirical tests and advances in the subject.

The starting point for a comprehensive theory of educational finance is most logically the longer run returns to education that are the ultimate outcome of the educational process. They are of three kinds: increases in monetary earnings that are a part of measurable economic growth, private non-monetary returns in the form of non-monetary on-the-job satisfactions and also during leisure time that improve the quality of human life, and external effects important to the functioning of democracy and other social institutions. Those returns taken as a whole are the main justification for the costs of education, although there are of course some measures of the more immediate outcomes that can also be related to costs. Human capital theory helps to bring the non-monetary returns to education as well as the monetary returns into sharper focus, as will be developed later in this book. So the concept of efficiency in the educational process

viewed primarily as a process of investment in human resources to the end of improving both earnings and the quality of human life will be a central theme of the theory of educational finance, and of this book.

But this is not sufficient. Equity is also important, especially where children and the life cycle of families are more deeply involved. American political and social institutions proclaim equal rights, and the equality of all citizens, but economic institutions rely on market-determined incomes that generate substantial inequalities in material welfare. This obtains head starts for some, so that the quality and quantity of education available to children and hence children's opportunities are unequal. For those whose parents incur penalties in the market place, the result is a degree of deprivation that conflicts with the younger person's individual freedom of choice and with democratic values. Equity considerations therefore must have an important place also in a broader and more relevant theory of educational finance.

There are trade-offs between efficiency and equity; greater equality in the resources devoted to each child can sacrifice some efficiency in the total amount of learning as a result of too much time being devoted to the slower students, for example. But there are also complementarities. There is some evidence that there is kind of an "Engel's law" of educational expenditure, for example, whereby the more affluent school districts and the more affluent colleges and universities spend increasing percentages of their budgets on things other than instructional staff not always to the end of supporting improvements in quality. To the extent that there are some elements of waste involved, this is an instance where greater equality in expenditures per pupil could simultaneously increase efficiency in

learning. Conversely, greater efficiency can release scarce educational resources which can then be made available to improve equity in ways that benefit all who are concerned. Instances which improve both efficiency and equity can be, in a sense, "Pareto moves" that leave nobody worse-off, and are deserving of some special attention in this book.

To draw together these new elements into a central theme, the theory of educational finance to be suggested here focuses on efficiency and equity in investment in human resources as a means of fostering humane growth. The efficiency and equity aspects are taken here to include not just the trade-off's, but also the complementarities. And humane growth as a goal will be taken to mean not just the economic growth of measured output, but also the non-monetary contributions of education to improvements in the quality of human life and to distributive justice.

I. Human Capital Formation

The concept of investment in human resources and of human capital formation has given a structure and precision to the economics of education that it has not had heretofore. In fact, human capital theory is having a revolutionary impact on the economics of education as well as on several other branches of economics, with waves of implications that are now permeating research on educational finance and educational budgeting. There are also some practical implications already for decision makers in the financing of primary, secondary, and higher education. It is important therefore that we start by considering briefly the more recent developments in human capital theory in order

to relate them in a broader theory of educational finance and draw out their implications for financing and for ongoing research.

Investment in Human Capital Over the Life Cycle

Human capital will be taken here to mean the accumulated stock of skills and personal attributes created by education, that in turn yields a flow of monetary earnings during work-time and non-monetary services largely during leisure time hours over the remainder of the life cycle. Not that there may not also be consumption satisfactions enjoyed by the student during the current period while he or she is still in school, but there is also an investment that yields returns later. As developed originally by Gary S. Becker (1964, 1975, 1976) and T. W. Schultz (1961, 1974) the investment involves not only an investment in market goods in the form of teachers salaries, books, and the operation of school and college buildings, but also an investment by the family of the parents' time and of the student's time.

This brings us to the first important concept involving human capital formation via education that is extended by the research in this book: the concept of household production of human capital that includes the use of the parents' time and of the student's time in the educational process. Charles Benson (in Chapter 3 of this book) creatively explores new ground by investigating the role of the parent's time and their socioeconomic status, and how these parents' time inputs relate to the efficiency and equity of human capital formation. The amount of time students invest is, as every college teacher knows, very important to the learning process. The amount of time invested by each student within the classroom is also important.

J. Alan Thomas (Chapter 4) also explores new ground in this book by investigating the determinants of the "time on task" in school classrooms. This is suggestive of how the efficiency in the use of student time might be increased. This is important, for as he also points out, although there may not be costs of student time at the elementary level that appear either in the school budget or as foregone earnings, there are opportunity costs to the student and to the society in the form of learning opportunities missed. T. W. Schultz (Chapter 2) also suggests that there are quite a few learning opportunities missed. These are missed, he suggests, by the failure to adequately decentralize educational decision making, especially in the larger city systems, in ways that it can more effectively involve the parents' time. Student time wasted, and parental time not utilized effectively, represents costs in efficiency to the society. This has important implications for educational policy makers who are charged with the public trust of securing efficiency in the use of all resources provided by society and with acting on behalf of society as a whole. It is human capital formation in this broader sense, that yields earnings and non-monetary benefits to individuals and society that is ultimately being financed.

This concept of a household production function for human capital needs to be made more precise and extended, for it is not only used by J. A. Thomas and C. Benson, as well as being implicit in the paper by T. W. Schultz, but it also arises many times in other papers in this book. Production functions will sometimes be used in the more partial sense to refer to the production of intermediate outputs by schools which in a sense become purchased inputs in the broader process of

producing human capital. But one of the first developments of the optimal production of human capital that accommodates inputs of student time and parents time in a life cycle context is found in early work by Ben Porath (1967). Because it is basic, it will be useful to review its significance briefly. It has been made a part of a more general theory that includes non-monetary returns by Gary Becker (1976) and James Heckman (1976) in more recent work that will be considered shortly.

Specifically, the Ben-Porath production function allows for examining efficiency in the use of student time and parental time by treating additions to the stock of human capital through education, Q_t, as a function of these as well as of purchased formal schooling inputs:

$$(1) \quad Q_t = \beta_0(s_{1t}K_t)^{\beta_1} D_t^{\beta_2}$$

In his notation, s_{1t} is the percent of student time, (and hence of the available stock of the student's human capital, K_t) allocated to the production of additions to the stock of human capital, Q_t. D_t are the purchased inputs of formal schooling, and college buildings. The parameter β_0 allows for the environmental inputs of parental time, and the parameters of β_1 and β_2 allow for this student's ability, which may differ from that of his peers. The process is not necessarily linear in the logs as shown, but this is a simpler starting place for purposes of solution, estimation, and exposition that does allow for analysis of the substitution between student time and other inputs in the learning process.

The power of this concept of production of human capital is not limited to its usefulness in analyzing efficiency in the use of student time, parental time, and teacher time toward increasing the value and usefulness of the student's time. It is even more important in the unifying concept that it provides for all of educational finance, since it can apply to pre-school education when the students' existing stock of human capital, K_t, is small, to formal schooling at K-12 or college levels as K_t grows, and to on-the-job training and continuing education in later years. When only monetary earnings are considered, the solution for the optimal investment in education shows the efficiency of further full time vocationally-oriented education tailing off in the later years of the life cycle, largely due to the fact that fewer years remain before retirement during which the increased earnings can be secured, a point that has obvious financing implications.

Extensions of Ben Porath's solution for optimum production of human capital represent even greater promise for a theory of educational finance. A major one, for our purposes, has been the development by Gary Becker (1976, p. 89) starting back in 1965 of a second and additional concept of household production that uses the stock of human capital in the household to produce not only earnings during work-time hours, but also a flow of utilities or services largely during consumption-time hours. These utilities, together with Becker's concept of "full income," provide a conceptual basis for the analysis of non-market behavior and for the measurement of the non-monetary returns to education.

This second form of household production yields consumption services, x_t, which appear in the household's utility function and yield

satisfactions over each remaining year of the life-cycle, including those years after retirement. Specifically:

$$(2) \quad x_t = \alpha_0(s_{2t}K_t)^{\alpha_1} q_2^{\alpha_2}$$

where s_{2t} is the proportion of time spent not at work but spent "producing" consumption-time satisfactions x_t while using the available stock of human capital K_t, and q_t are market goods. α_0, α_1 and α_2 again are parameters reflecting environmental factors and abiity, and the log-linear functional form is not essential but merely chosen for convenience. For example, if q_t is a book purchased on the market, K_t is the skill at reading acquired through formal education, and s_{2t} the proportion of total time spent reading, x_t is a flow produced during the consumption time that directly yields the utilities or satisfactions from reading a book. The point is developed further in W. McMahon (1974, p. 28), and the newest research related to it is creatively reviewed and extended by Robert Michael (in Chapter 5 of this volume). In principle, the non-monetary returns to education to be measured are:

$$(3) \quad \sum_t \frac{\delta x_t}{\delta(s_{2t}K_t)} \; p_t x_t d_t$$

The first term is the contribution of one unit of educational capital used during consumption time hours to private satisfactions, p_t is the shadow price or value of these service flows, and d_t is a discount factor that discounts non-monetary returns arising later in the life cycle back to their present value.

The final extension of the concept of optimal investment in human capital over the life cycle to be considered here is also essential to

the analysis of the efficiency of the process. It is largely due to work by James Heckman (1976) and Blinder-Weiss (1976) who have formally joined the theory of labor supply (which determines monetary earnings) and the theory of consumption (which includes not only the effects from spending the earnings yielded by human capital during work-time but also the non-monetary returns from the use of human capital during consumption-time) to the theory of investment in education over the life cycle. For the first time, the optimal accumulation of human capital at each stage in the life cycle is derived from the point of view of a utility maximizing household who must also choose the timing of its labor supply to obtain earnings as well as its inter-temporal allocation of consumption.

This much lays the groundwork for the analysis of benefits, costs, and private efficiency conditions as they relate to investment in education. Human capital concepts also have a significant contribution to make to analysis of the sources of inequality in the income distribution, but this will be considered later in connection with equity.

II. Efficiency Criteria

Increased efficiency frees resources that can be used to improve the quality of education, or to prevent it from deteriorating in a period of budget stringency, as well as freeing resources that can be used to improve access. Cost-benefit criteria are the relevant ones to use to test whether efficiency is being attained or could be improved in any specific situation.

After considering the distinction between efficiency and equity, production efficiency and exchange efficiency will be defined. Then

a cost-effectiveness, cost-benefit hierarchy of efficiency criteria that centers on the problem of measuring the benefits and that goes from lower to higher levels will be proposed, analogous to the hierarchy of equity criteria to be developed in Section III.

The Distinction Between Efficiency and Equity

Efficiency is defined to mean the potential for increases in the desired outcomes of education without increases in the physical quantities of resource inputs. Efficiency also means (through duality theorems) the maintenance of the same quantity and quality of educational outcomes while minimizing the real resources used. To merely maintain the quality of the education received by students is a common problem in the face of declines in real resources due to inflation, fixed costs that are hard to reduce as enrollment declines, and inflation-induced tax revolts.

Having indicated what efficiency does mean, it is important to stress what it does not mean, for misunderstandings by administrators, teachers, and non-academic employees can impede progress that can benefit students, staff, and taxpayers alike. Efficiency does not mean "speed up" in the pace and volume of work of teachers and staff which has had negative connotations since the industrial revolution. Increases in the number of pupils per teacher, for example, without commensurate increases in real salaries are technically "non-Pareto moves" of the type discussed below, since they leave some worse off. They therefore are not efficiency moves in the strict economic sense of Pareto-efficiency, but must be considered under the heading of equity-type questions. The word efficiency refers instead to finding

better ways of doing things, reducing the effort needed to secure the same outcomes, or improving the outcomes without increased effort.

To distinguish efficiency from equity, the central criterion is that improvements in efficiency involve changes that make at least one person better off and no person worse off, whereas equity can involve redistributions of benefits or of real income that can make some worse off, to the end of attaining distributive justice. Efficiency moves therefore are Pareto moves, defined as moves that make at least one person better off and none worse off. Each such move is a move East, or North, or Northeast in Figure 1 below, where the utility from schooling, or lifetime full income, of A and B are measured on the two axes. When all possible moves of this type have been made, line BB, the grand utility possibility frontier has been reached, and Pareto efficiency has been attained. Any point below or to the left of BB such as point Z is inefficient, since any improvement in efficiency that makes possible a move to point X makes individual A better off. Similarly a move from Z to Ω would make individual B's utility or real income higher without hurting individual A, and any movement toward the northeast from Z would improve the welfare of both. This Pareto criterion is a minimal ethical principle, and the central criterion of Welfare Theory in economics. The Hicks-Kaldor Compensation Principle, which allows for compensation to be paid to disadvantaged parties (e.g., to a teacher whose class size has been increased, or to a home-owner whose house is destroyed to build classrooms), reduces to the more central Pareto criterion when compensation is paid since after the payment of compensation, no one is worse off.

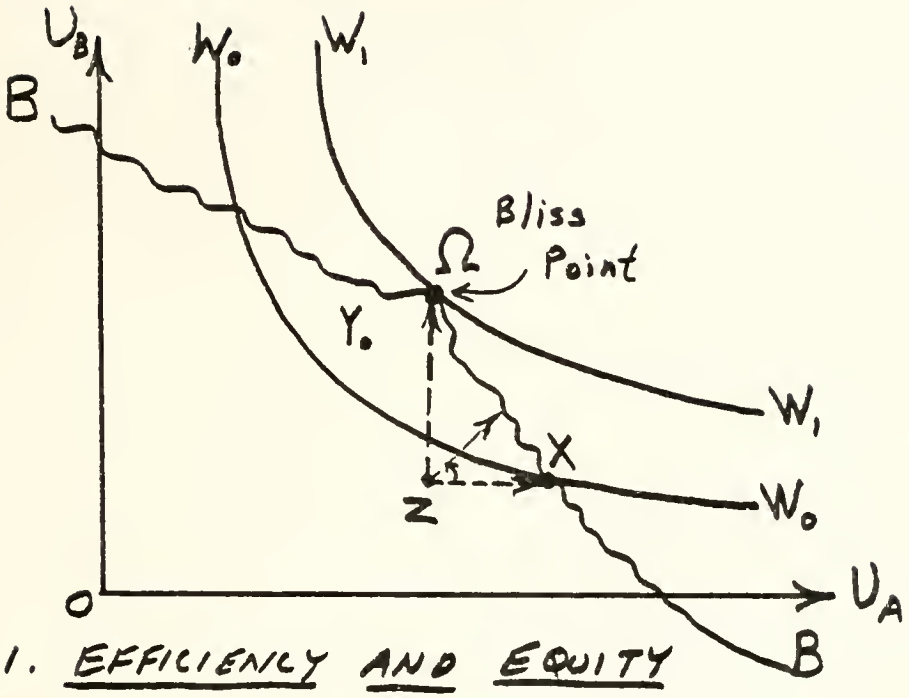

FIGURE 1. EFFICIENCY AND EQUITY

Equity goes beyond the attainment of efficiency. Even after all possible improvements in production efficiency and exchange efficiency are made so that the grand utility possibility frontier is attained, there still may be considerable inequality in the distribution of benefits. At point X for example, where Pareto efficiency has been attained, individual A who could be a student is benefiting greatly in the present and future utilities he is receiving, whereas perhaps very little is spent on student B's education and his benefits as a result are impoverished. If now there were an omniscient ethical observer whose perceptions of social welfare are given by the welfare function WW, the problem of what is equitable can be solved. The contour line W_1 W_1 represents a higher level of social welfare than does the contour line W_0 W_0 on which point X is located. So a move from point X

to point Ω, the point of constrained bliss, redistributes resources away from Student A and toward Student B, constituting an increase in equity that is also an increase in social welfare. The paper by Kern Alexander and T. R. Melcher (Chapter 10) addresses the philosophical foundations of equity.

Trade-Offs on Complementarity

Trade-offs between efficiency and equity do occur and are the aspect usually stressed, rather than the possibility of complementarities. Some educational systems such as those in England and in some private schools emphasize screening and investment of the most resources in further development of the brightest minds, more than do others, because of the losses of efficiency if more resources are used with the slowest students. In the economy as a whole there are also trade-offs; differentials in earnings serve as important incentives--rewards and penalties--to promote efficiency in the use of resources. But the very effectiveness of this incentive device depends to some extent on a reasonable degree of equality of opportunity at the starting line. Within education there are also other reasons for complementarity--notably, children are wards of their parents, and differences in expenditure per child (unrelated to ability) that merely make students suffer for the lack of wealth of their parents in a somewhat capricious fashion is not a positive incentive that can be defended on the grounds that it promotes efficiency.

We suggest in this book that there are in fact a number of possible complementarities, where both efficiency and equity are a

simultaneous result. In Figure 1, for example, a move from Z to Ω increases efficiency by moving toward the Pareto-efficient utility possibility frontier, while simultaneously improving equity by increasing the equality of benefits or of lifetime full income received by Student A and Student B. In contrast, a move from X to Y involves a trade-off in the sense that equality, and social welfare, are increased (since Y is above W_0 W_0) but only at the cost of a loss in efficiency.

T. W. Schultz has some interesting suggestions to make (Chapter 2) about organizational changes within the education sector intended to improve efficiency, moving outward and upward from points like Z in Figure 1 and thereby freeing resources that can be used to improve child equity.

Production Efficiency and Exchange Efficiency

Efficiency has two major aspects: production efficiency which refers to the efficiency with which inputs of time and resources are combined in the educational process to secure desired outcomes, and exchange efficiency which refers to the efficiency with which appropriate educational outcomes are matched with educational needs.

Production efficiency is developed in Figure 2a with two inputs, and in Figure 2b with two outputs, based on the production function given by Eq. (1) above. For the two-inputs case isoquent Q_0 Q_0 illustrates combinations of student time and teacher time used to produce one unit of output, as used by J. Alan Thomas in Chapter 4 to investigate the efficiency in the use of teacher time as it is used to elicit student "time on task."[1]

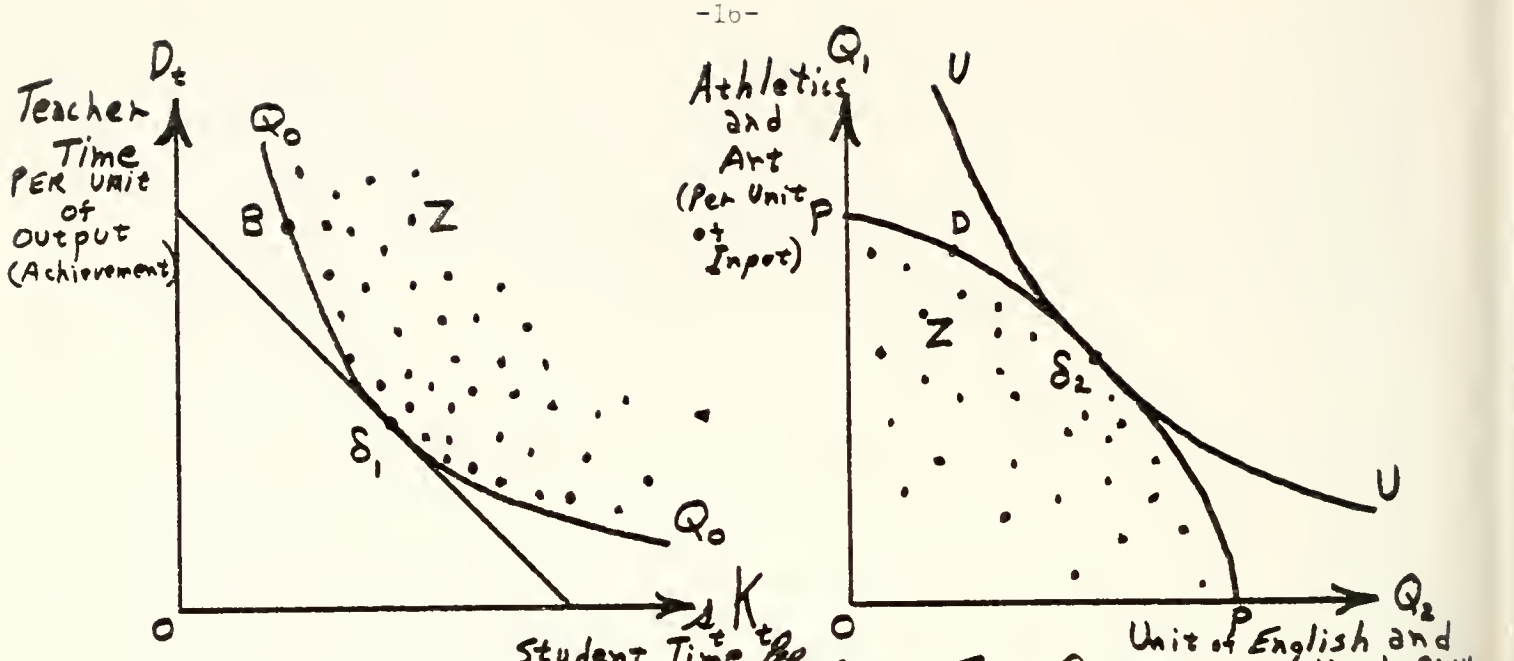

FIG. 2a. TWO INPUTS FIG. 2b. TWO OUTPUTS

The isoquant in Figure 2 is a unit isoquant (with the index of output and all inputs divided by the output index), so that all output dots above Q_0 Q_0 are less efficient production points. Technical efficiency exists when any point on Q_0 Q_0 is reached, characterized by a reorganization of available resources in such a way that efficiency is maximized. Price efficiency involves further consideration of the cost of resources used. In this case, the costs of teacher-time and the costs of student-time as measured by foregone earnings or other opportunities is weighed until the most productive combination of resources is obtained. A movement from Z to B constitutes an improvement in technical efficiency; a movement from B to δ, constitutes an improvement in price efficiency; and only at δ is full economic efficiency achieved.

Production efficiency in education also involves the choice of optimum outputs, among various alternatives, as illustrated in Figure 2b. There is more than one output in education at both the intermediate

and final-good levels. Within higher education, for example, there are instruction, research, and public service at the intermediate-good level, as well as breakdowns in terms of disciplines and individual courses. At the final, or more ultimate outcome level there are monetary and non-monetary returns over the life cycle. At elementary and secondary levels there are breakdowns by subject and between cognitive and non-cognitive outcomes. Figure 2b illustrates a choice between academic skills and athletics common to both, with inefficiency points below the production frontier, so that a movement from point Z to point D constitutes achievement of technical efficiency. There is no pure price efficiency since outputs are not sold for a price on the market, but there is an analogous concept that can be called allocative efficiency. It relates to the attainment of educational goals, given in this case by the educational policy maker's utility function UU. These goals are always implicit, and sometimes explicit, so that a movement from point D to point δ_2 constitutes an improvement in allocative efficiency.

This situation is typical of cost effectiveness analysis discussed by Richard Rossmiller in Chapter 8. Cost effectiveness decisions are made every day by Vice Chancellor's for Academic Affairs and by school district superintendents, but since the cost effectiveness analysis that is done is normally implicit rather than explicit, it often does not go by that name. The state of the art of cost effectiveness analysis that is creatively surveyed by Richard Rossmiller in Chapter 8 is illustrated for a particular school system by Terry Geske in Chapter 9. This theoretical framework, with the production function

as shown in Figure 2, brings out quite forcefully the point that appropriate results from cost-effectiveness analysis, and the achievement of economic efficiency, depend heavily on the appropriate specification of educational goals.

Exchange efficiency, in contrast to production efficiency, deals with the exchange or delivery of a given output of educational services to families. It involves changes until the lifetime utility of students and families cannot be further increased. The total lifetime returns from education for Student A and Student B in Figure 1 are sensitive to how the fixed totals of math, English, aesthetic programs, and health programs are distributed between them. These fixed totals represented by points δ_1 and δ_2 in Figure 2 when distributed between Students A and B in a fixed way are on a utility frontier in Figure 1 that is below line BB; a reallocation of these educational outcomes between them could improve exchange efficiency and move the welfare of all outward to line BB, the grand utility possibility frontier.

Human capital skills cannot be exchanged among students since human capital is embodied in individuals. But there are many examples of the potential for increasing exchange efficiency in education as these skills are being created, and as students are allocated among classes and institutions. Special education programs that try to match programs with needs and abilities, free choice by college students of their major, and the nationwide occupational and institutional choice information system developed by ACT all have a bearing on exchange efficiency. Budgeting and financing decisions that limit resources in some fields, sometimes due to trade union and other

monopoly restrictions, lead to unrealistically high test score requirements and quotas in those fields and exchange inefficiency.

In this book exchange efficiency arises in connection with the discussion of student aid programs designed to release the constraints of scholarship and other financing patterns that require attendance at particular institutions. Roe L. Johns discusses voucher plans in Chapter 11 which are still at an experimental stage at the elementary and secondary levels, partly because of the concern that they could be used to finance segregationist and religious schools in spite of limits on this rooted in the Constitution. Walter W. McMahon and Alan Wagner consider in Chapter 6 the widely different monetary rates of return to education found in different college-related occupations, and their relation to the choice by students of their college major. The Community College movement and the Federal Basic Economic Opportunity Grant program also are related to exchange efficiency (apart from their equity objectives) by widening the range of options available for choice, both among curricula and among institutions, assuming students are reasonably knowledgeable about their longer run best interests. All provide a degree of competition which, together with continuing internal efforts for accountability and cost effectiveness, enrolls the user in helping to police the system.

An Efficiency Criterion Hierarchy

Overall efficiency criteria are essential if it is to be determined whether each practical budget decision in the financing of education will or will not improve economic efficiency. Economic efficiency in turn is essential if massive waste is to be avoided and

(together with equity criteria) further progress made toward the bliss point and humane growth.

The efficiency criteria hierarchy suggested below is designed for use within public and private non-profit institutions because educational institutions are almost always of this type. We do not choose to enter into the public sector private sector debate for the most part in this book, but instead take the view that all non-profit institutions normally have clear incentives to minimize waste and normally take steps to do so as best they know how. Many of the problems are merely with the state of the art. Public institutions, and private institutions can reasonably be assumed to seek to optimize the quantity and/or quality of their outputs within the budgets that they are given (although outsiders may not always agree with their goals). For if they do not, boards of trustees, school boards, and legislative support become disaffected, budget support for subunits and whole units erodes, and administrators are replaced eventually and quietly without outsiders being aware of the reasons. A managerial discretion model for non-profit institutions developed and tested by W. McMahon and C. Strein (1979) suggests that discretionary revenue sometimes exists, and that optimizing behavior does not preclude some inefficiency. A theory of public sector institutions alone has been developed further by W. McMahon (1970, 1971). Earlier A. Downs (1957) and others have considered this replacement process.

The following efficiency criterion hierarchy is suggested, ranked from the lowest efficiency criterion to the criterion that would guide faculty governance systems and administrators toward the highest level of efficiency. The problems in measuring the outputs is a well known

limitation of the state of the art that forces practical applications toward lower-level efficiency criteria such as cost-effectiveness analysis of intermediate outputs, but the progress being made in measuring outputs will be discussed later in this book. Finally, these efficiency criteria are limited to a focus on efficiency; they provide no guidance about equity:

1. Simple Accountability Tests. Normal financial accounting controls, and checks on whether listed course offerings are accurate, are lower level efficiency criteria since they fail to analyze functional relations, costs, or usefulness of the services. This type of efficiency criteria is often all that is used since most schools and colleges do not possess management information systems that are sophisticated enough to obtain even approximate relationships between changes in educational practices and outcomes. Competency testing is a somewhat better measure because at least it tries to measure outputs, rather than inputs. The interesting debate over national competency testing is considered by Allan Odden in Chapter 16. But from the point of view of efficiency criteria, competency testing is still at the lower end with other accountability tests.

2. Production Function Relationship. These help to select the more effective techniques useful in producing the desired outcomes. They can range from trial and error (what works) to simultaneous production function relationships of the type included in Elchanan Cohn's model in Chapter 13. They are still not among the highest level efficiency criteria because they give no consideration to the costs of inputs involved in producing the outcomes.

3. Cost-Effectiveness Analysis. Costs are considered in relation to the output quantities obtained. Frequently only part of the costs are included, omitting the cost of student time, with the point of view limited to that of the institution. Frequently also only the intermediate outputs such as instructional units are analyzed with longer run outcomes ignored. However, even with these limitations, if the decision maker's goals are well conceived, cost-effectiveness ratios can be helpful guides to increased efficiency. As mentioned above, most cost effectiveness analysis is implicit, as educational policy makers make daily decisions, but an excellent survey of more explicit current applications is offered by Richard Rossmiller in Chapter 8.

4. Cost-Benefit Analysis. Costs are considered in relation to the value of outputs, and either benefit/cost ratios, or rates of return which are a form of benefit/cost ratios are calculated. As practiced in the economics of education thus far, the measurement of benefits is usually limited to monetary earnings which are the more easily measurable part, although full costs are considered. These monetary returns to education over time, by type of occupation, and by type of institution are considered by Walter W. McMahon and Alan P. Wagner in Chapter 6.

The highest level of private efficiency criteria is finally achieved when the non-monetary private returns of the type considered by Robert T. Michael in Chapter 5 are measured and included in the measure of benefits.

5. Cost-Benefit Analysis with Social Benefits Included. The highest level efficiency criterion from the point of view of society

as a whole must consider the full costs as well as the full benefits to society when calculating more comprehensive rates of return or other benefit cost ratios. The student needs think only about the private benefits and private costs to himself and his family, but those educational policy makers whose responsibility is to think about all persons in their jurisdiction must include the full benefits, including the benefits of research to future generations and the spillover benefits from education to society in relation to the full cost to society, including the tax cost and endowment fund subsidies in their calculations. Thomas Jefferson had a great deal to say about the importance of mass education (he urged public support by the State of Virginia for it) to effective individual participation in the democratic process as a key means to the preservation of our freedoms. These are undoubtedly the hardest kind of benefits to measure, although considerable progress has been made in measuring the benefits from research that go beyond those received by the individual scientist or his institution.

Improvements in private and social efficiency can be viewed as a disequilibrium process, investing where the rates of return (or benefit/cost ratios) are highest, since investment at these points has the greatest payoff in benefits for each dollar invested. As this process continues fewer resources are wasted and progress is made toward production and exchange efficiency in creating human resources and securing the full benefits of education. As measures of the non-monetary private and social benefits gradually improve, the higher level efficiency criteria can be used more often as the criteria relevant to attainment of the grand utility possibility frontier. Given

the criteria, improvement in the measurement of non-monetary private and social benefits can also be important in increasing education's contribution to humane growth.

III. Equity

The concern with equity has dominated the educational finance literature. In school finance, this dominance has been overwhelming; in higher education finance it has not been as exclusive of other concerns but has been pervasive.

The focus of the concern with equity is almost exclusively on the point that family income or wealth should not dominate differences in expenditure per pupil among school districts or control access to a college education. The reason for this focus in the educational finance literature is probably in the deeply held individual beliefs in our society that fairness is important: equal treatment of equals in the opportunities available in life and fairness in competing for earnings in the market, especially at the starting line. Reinforcing this, widely held philosophical values tend to go even more deeply in western civilization to include belief in the innate worth in each human soul. In responsive representative systems widely held individual beliefs such as these get translated into public policy. The result is a social contract that is expressed in the educational finance literature as child equity and tax equity.

Yet inequity still permeates the system. It is evidenced by vast inequality in expenditure per pupil among states and within states. Some inequity arises as the result of the trade-off with efficiency--but not all. Whether a nation's best interests lie with universal

education or with concentration of resources on the higher ability groups is a compelling question. But the vast inequality in expenditure per pupil among school districts, among community college districts, and in the percentage of children from high income and low income families that go to college has little connection to early student ability and is hard to justify from a longer range perspective on efficiency grounds.

In spite of the emphasis on equity in the literature, and the inequity that persists, the recent state reform efforts at the elementary and secondary level are shown by Stephen Carroll in his definitive econometric study in Chapter 14 to have led to some improvement in tax equity, but little per pupil equalization. Student equity deserves therefore to receive greater emphasis than tax equity, since tax equity is a concern shared with the broader profession of public finance economists whereas student equity is the more pressing problem within educational finance, and the one on which less progress is being made.

The place to begin this theoretical framework for the inclusion of equity considerations therefore is with student equity, which will be extended to include intergenerational equity as it relates to the intergenerational transmission of inequality. This will be followed by an hierarchy of equity criteria.

Types of Equity

The term student equity will be used to include both horizontal and vertical equity among pre-school, elementary, and secondary pupils (child equity), as well as among community college, college, graduate,

on-the-job training, and senior citizen adults. Efficiency considerations become relatively more important than equity in graduate education and in access to on the job training programs in later years. But efficiency criteria do include the non-monetary private and social benefits of education some of which are especially relevant to the years after retirement.

Measures of equity all require the assumption that it is possible to make inter-personal comparisons of utility, an assumption that takes practical work with equity out of the scientific confines of pure economics. But these measures are not outside the range of philosophy, and of concepts important in western civilization such as equal rights, and the equal worth of each human life at least when net of any human capital additions. Lionel Robbins in a nice statement on interpersonal comparisons of utility (1938) says, "I do not believe and I have never believed that in fact men are necessarily equal or should always be judged as such. But I do believe that in most cases, political calculations which do not treat them as if they were equal are morally revolting." The philosophical and legal roots of equity are investigated further in a scholarly and fascinating way by Kern Alexander and T. R. Melcher in Chapter 10, and there will be other opportunities to draw on their contribution in this introductory chapter.

Horizontal equity, or equal treatment of equals, is important both to student equity and to tax equity. Within student equity it implies equal expenditure on pupils of equal ability and capacities, using the philosophical and legal bases for making interpersonal comparisons,

rather than economics, as indicated above. A very interesting discussion of the current concerns at the national level with child equity appears as part of Allan Odden's contribution in Chapter 16.

Horizontal equity in taxation under the same assumptions implies equal tax effort among taxpayers who have equal income and wealth. Tax effort is measured by expressing tax receipts as a percent of income and assets (or total wealth including human capital) to obtain an effective tax rate. In practice, wealth in school finance has usually been limited to a measure of real property wealth, the tax handle available to the school district, although an increasing number of states have turned toward a measure of wealth that includes income and toward the use of circuit breakers for low income families in order to relate the concept of fairness to individual taxpayers, the effective rates they pay, and their ability-to-pay.

Vertical equity, or unequal treatment of unequals, when applied to either the expenditure side or the tax side must resort to the equal sacrifice doctrine of public finance developed by Edgeworth, (1925, pp. 100 ff), and R. Musgrave (1959, pp. 90-115, and others. On the philosophical and legal basis for interpersonal comparisons mentioned above, the maximization of social welfare at point Ω_1 in Figure 3a below requires equal marginal benefit (which maximizes the total benefit from education received by all), as well as equal marginal sacrifice (which minimizes the total sacrifice borne by taxpayers. For students whose abilities are equal and whose parents socio-economic status is the same, equal marginal benefit would imply equal expenditure per pupil (as in Figure 3a). In this case, horizontal equity and vertical equity are identical.

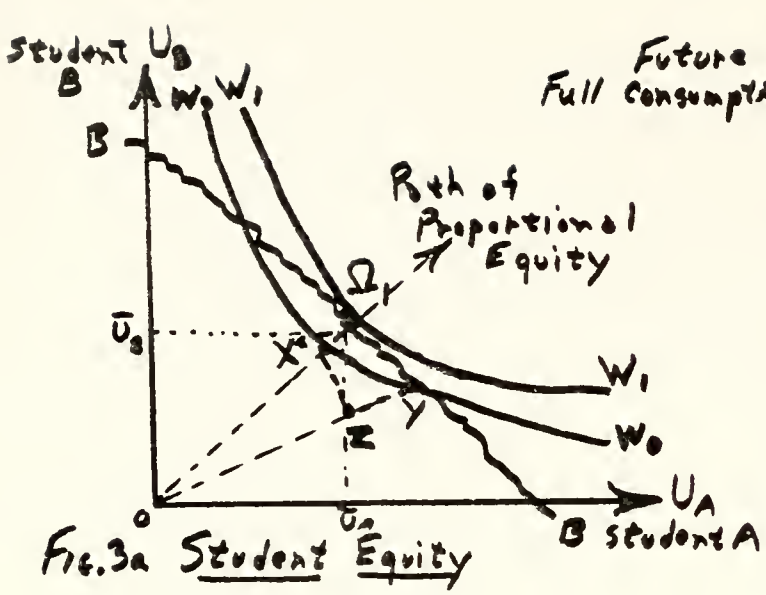

Fig. 3a Student Equity

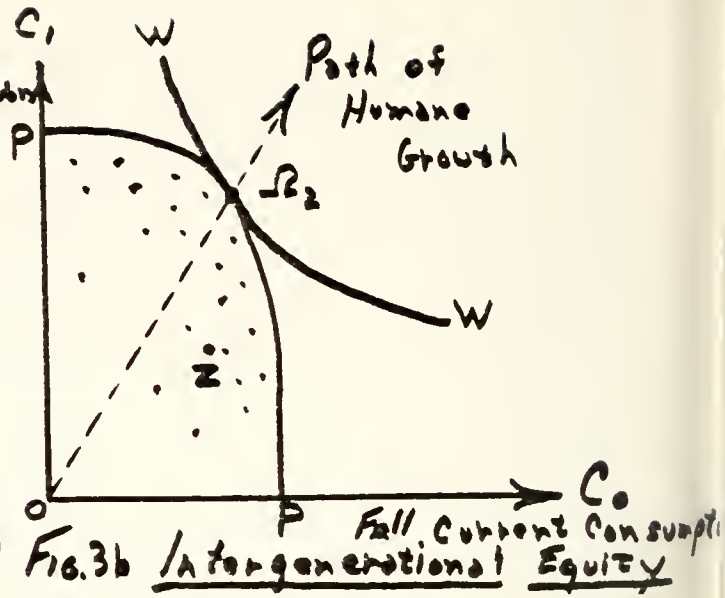

Fig. 3b Intergenerational Equity

However the parents' wealth and education which make up their SES are not equal. Those with higher income tend to live in the better school districts where there is larger expenditure per pupil, and to send their children through more years of post-secondary education. The parents' wealth taxed for support of the primary and secondary schools contributes to achievement through the ability to secure better and more experienced teachers, and through better support for special education programs as is brought out in the conclusions drawn by Richard Rossmiller from his interesting survey of production function studies in Chapter 8. Within the classroom, good teachers and smaller class tutorial arrangements also contribute to more "student time or task" as discovered in the work by Alan Thomas, F. Kemmerer, and D. Mork in Chapter 4, consistent with some positive relationship between school resources and achievement. But this is not to say that the school does or can do it all. The parents' SES, by facilitating choice of the neighborhood in which the family lives, is also associated with "neighborhood effects" and with the role-models enabling

the student to see more clearly the relation between education and the job market--factors which Charles Benson finds also to be related to achievement in Chapter 3. Finally, the effect of the parents' income and wealth on the child's education does not end with the secondary school, for in spite of the innovation of community colleges and Federal Basic Economic Opportunity Grants (BEOG's), the parents' SES is associated with more years in college and hence with more monetary and non-monetary returns to the student over his life cycle as is developed further in Chapters 5 and 6.

Intergenerational Equity. There is therefore an important intergenerational dimension to the concept of equity in educational finance, as is appropriately stressed by Susan Nelson in her discussion of it in Chapter 12. This is illustrated in Figure 3b, which measures the current full consumption (utilities) of the family on the horizontal axis, and future full consumption including the future lifetime full consumption of the children on the vertical axis. As parents invest resources and as children invest their own time in human capital formation, their capacity to enhance their future earnings and their non-monetary returns is increased. This increases the children's future full consumption (upward along line PP in Figure 3b). Since parents' resources are unequal, the future consumption of the children from the high income families is increased the most, and the result is an intergenerational transmission of inequality.

Intergenerational equity implies that the parents invest sufficiently in their children's education that current and future full consumption (utilities) of the family are maximized. Children are

without resources, and myopic, so the parents invest considerable amounts in their behalf. Some parents are myopic, or selfish, so from an equity point of view, the omniscient ethical observer must be called upon again to locate the welfare function WW in Figure 3b. If this involves an efficient solution in the sense that current plus future consumption are maximized, and an equitable allocation of this consumption between the two generations, then the point of constrained bliss at Ω_2 in Figure 3b is located for this family.

However not all families have equal financial resources. Therefore it is only after steps have been taken to achieve vertical equity among unequals that point Ω_2 in Figure 3b also implies achievement of social bliss. Then the path of efficiency and equity over time, as the production opportunities set expands, is designated the path of humane growth.

What Does Vertical Equity Imply?

Given that there are differences in parental and student economic resources (or SES) that do make a difference in the future full income and consumption of individuals, what does vertical equity imply? On the tax side does it imply equal effort in school finance (i.e., equal tax rates which amount to proportional taxation) and equal "expected parental contributions" as a percent of income (again proportional rates) in the need analysis procedures used in higher education finance? Or does vertical equity imply progressive tax rates?

Similarly, on the benefit side, does it imply equal public expenditure per pupil recognizing that private expenditure is very unequal, or does it imply reverse progression in the benefit rates in the form

of special programs for the low income disadvantaged and costly special education programs for the handicapped? The concept of positive equity developed by the philosopher John Rawls corresponds more closely to progressive rates on the tax or on the benefit side taken alone since it involves the effort to correct social wrongs borne by the recipient for which he was not responsible.

The answer is not simple. If one sticks purely to equity terms, the equity principle of equal sacrifice does not necessarily imply progressive rates. Assuming that there is a declining marginal utility of income, in the sense that the last dollar of income is worth less when one is wealthy than it is when one is poor, equal absolute sacrifice and equal proportional sacrifice can still imply regressive or proportional rates on either the tax or the benefit side, as is more typical of current state and local educational financing activities. The trends in state taxation creatively analyzed by John Due, an expert in this field, in Chapter 15 suggest some shifts toward roughly proportional state income tax sources in recent years, with Proposition 13 perhaps affecting student equity by shifting a larger percent of the support for the schools to the state level.

Viewed from the point of view of maximizing social welfare, and obtaining the bliss points Ω_1 and Ω_2 in Figure 3, the equity principle of equal sacrifice and equal benefit must be interpreted as equal <u>marginal</u> sacrifice and equal <u>marginal</u> benefit, which would be the criteria for maximization of welfare and minimization of aggregate sacrifice. Equal marginal sacrifice in turn, under the assumption of the declining marginal utility of income, requires progressive tax rates such as are found in the Federal income tax. Equal marginal benefits

in the ultimate returns from education imply reverse progression in the benefit rates as illustrated by the Federal Title I programs for disadvantaged elementary school pupils and BEOG grants for college students from poor and low-middle income families.

The Trade-Off and Complementarity with Efficiency

Going too far in this direction runs into a conflict with efficiency. Vertical equity that minimizes aggregate sacrifice on the tax side would require equal incomes, and vertical equity on the benefit side would require not only corrective programs, but also equal expenditure on all students of equal ability. This loss of efficiency would shift the grand utility possibility frontier in Figure 3a to the left, and prevent the attainment of the bliss point at Ω_1. T. W. Schultz develops this point further in his contribution in Chapter 2.

In addition to the potential loss of efficiency, the resources available to education (and hence lines BB and PP in Figure 3) can sometimes be affected adversely, as suggested by John Due in Chapter 15. He suggests that special programs can sometimes become very costly, especially when they are supported through the political process by well organized groups. There are the expenditures required to equip busses and buildings for paraplegics, for example, or some special education programs in the schools. These costs can appear wasteful to the taxpayers, and lead to a taxpayers reaction that shifts the resource constraints downward.

But the most important potential exists where complementarities permit equity and efficiency to be produced simultaneously. If ability measures largely reflect achievement and parental SES, rather

than innate ability, then vertical equity is less in conflict with efficiency, and even meritocracies can be more equitable, for example.

An Equity Criterion Hierarchy

Overall equity criteria are essential if it is to be determined whether or not each budget change in the financing of education reduces inequity. Then, together with use of the efficiency criteria, if there is an improvement in equity with no reduction in efficiency, a contribution is being made to humane growth.

Public institutions have an incentive to be equitable whenever one-man-one vote systems and provisions for equal extension of the franchise prevail. If groups that have the vote cannot gain or maintain access to educational institutions, they hope the opportunity to vote more or less as a block, shifting the center of balance as between the major factions in power somewhat in their direction. Private schools and colleges frequently have such an incentive also, since they are normally non-profit institutions, originally associated with the church, and frequently include an element of altruism among their objectives. The College Scholarship Service, for example, was originally founded with the support of private school financial aid officers who sought through their mutual efforts to minimize the "buying" of students and make the size of the student aid offer reflect financial need more adequately.

An equity criterion hierarchy is presented below. It should be made very clear that it goes beyond pure economics because it requires interpesonal comparisons of utility, and draws on wider philosophical bases

such as those cited above by Lionel Robbins in order to make such comparisons. To arrive at a rank order of the criteria listed, there are at least three bases that point toward roughly the same ranking: a) maximization of social welfare which is attained only by moving toward equal marginal educational benefit and equal marginal tax sacrifice, b) Supreme Court rulings as analyzed by Kern Alexander in Chapter 10 which include the recent rulings in state supreme courts, and c) the philosophical basis of equity as an ethical principle, as developed recently for example by John Rawls (1977).

The equity criteria developed here keep equity on the tax side and equity on the expenditure side conceptually separate, rather than merging the two criteria. This approach is consistent with that chosen by Joseph Peckman and by Susan Nelson in her analysis of equity and of changes in equity in post secondary education in Chapter 12.

1. Commutative Equity, the first level, implies that the state leaves undisturbed the results of the market place. In its most extreme form, it leaves little room for public schools even at the local level for even within localities there is some interfamily redistribution of benefits. Within the private sector, in its extreme form the existence of purely selfless altruistic motivations tends to be challenged by the concept of commutative equity, and presumably private scholarship funds would be used only to attract the most able students--if there were less prior achievement for whatever reason, need would not be considered. This reliance on laissez-faire implies emphasis on pure competition and opposition to monopoly, both of which can contribute to the achievement of Pareto efficiency. But this much alone makes no provision for wealth

transfers per se; they involve conflict as moves are made along the grand utility possibility frontier. The commutative equity criterion allows unlimited differences in wealth among parents to persist, unlimited differences in expenditure per child, and unlimited intergenerational transmission of inequality.

2. Fiscal Neutrality means the state will seek to achieve a degree of equity through transfer payments so that local educational institutions including community colleges are treated as though they had access to an equivalent amount of wealth per pupil. After attainment of an equal fiscal base (which seldom is attained under current practices) unlimited variation in local effort would be permitted, as would unlimited variation in expenditure per pupil.

State school finance systems generally go beyond commutative equity and part of the distance toward fiscal neutrality, although Serrano and later decisions in the California Supreme Court have continued to hold the California school finance system unconstitutional on the basis of the lack of fiscal neutrality, and most other state school finance systems could not currently meet this test. Similarly, the financing of higher education goes beyond commutative equity through for example, use of private scholarship funds based in part on need, state scholarship commission grants, and Federal BEOG grants based on need. But it also falls short of fiscal neutrality. Even if fiscal neutrality were approached in all educational finance, neither horizontal nor vertical equity among taxpayers nor among students would be fully achieved. This is because even if tastes were identical, the fiscal neutrality concept on the tax side measures wealth on a per student

rather than a per taxpayer basis, and measures only part of the taxpayers wealth, both of which disrupt taxpayer equity. On the expenditure side, even if wealth per pupil were identical, full student equity would not be achieved because pupils differ in other ways due to their past advantages and their capacities.

The achievement of fiscal neutrality, however, should move the current system which contains significant inequality in expenditure based on income and wealth toward greater horizontal and a higher level of vertical tax and student equity, and toward less intergenerational transmission of inequality.

3. Horizontal Equity, Plus (Proportional) Vertical Equity. This requires equal effort on the tax side, and equal expenditure per student of equal capacities on the expenditure side. It corresponds to Kern Alexander's "Restitution" level of equity in Chapter 10 which includes but goes beyond fiscal neutrality. Proportional taxation on the tax side involves more restitution than does regressive taxation, although true vertical equity must be expressed in terms of individual persons rather than school districts, implying that effort for this purpose must consider earnings as well as assets. Student equity in this case involves equal expenditure in real terms (and hence the cost-of-delivering education adjustments due for example to geographical differences in the cost of living mentioned by Alexander). Among students who are unequal, the clear definition of reverse-proportional vertical equity is more difficult. It implies rectification both of shortcomings at the local district level and proportional and non-progressive rectification for the culturally disadvantaged through special education programs. This

would not preclude the more able moving ahead faster, or completing advanced degrees more frequently.

This level of equity most closely corresponds to equality of educational opportunity. In achieving horizontal and vertical equity on both the tax and expenditure side, it still allows for differences in total expenditure based on differences in tastes (e.g., some tastes are more myopic) and on differences in innate ability. This level therefore severely reduces but would not eliminate intergenerational transmission of inequality of earnings.

4. Positivism, the fourth-ranked and final equity criterion includes all that has gone before but with respect to vertical equity, implies progressive rates on both the tax and benefit sides. This is Rawlsian equity, designed to have a corrective effect on the current income distribution, and to assist the least advantaged. As Alexander suggests, this would imply full financing by the state of high cost programs for the handicapped or the disadvantaged children and students, BEOG grants for the poor, and affirmitive action. It is consistent with concepts of equal marginal benefit, and hence with maximization of the social welfare function under the assumptions stated above.

Finally, it is suggested here that this level of positivism among equity criteria also implies a correction for those individual cases where parents and students have myopic tastes as the intergenerational welfare function shown in Figure 3b implies, quite apart from the social rate of discount required to attain the golden rule path. This fourth and final level of equity, therefore, also implies elimination of environmentally-induced intergenerational transmission of inequality, and attainment of intergenerational distributive justice among peers.

IV. Humane Growth

The contribution of all of education and of academic research to humane growth include their contribution to earnings, to non-monetary private and social benefits vital to the quality of human life, and their contribution (through intergenerational equity) to distributive justice.

On Hierarchy of Humane Growth Criteria

The challenge is to bring together the efficiency criteria and the equity criteria into what will be called humane growth criteria. A combined but practical criteria needs to be developed for use in specific budget decisions if inefficiency and inequity are to be reduced, and the contribution of education to humane growth in the society is to be optimized. In sum:

Efficiency Criteria	Equity Criteria
1. Accountability	1. Commutative Equity
2. Production Function Relationships	2. Fiscal Neutrality
3. Cost/Effectiveness	3. Proportional Equity
4. Cost/Monetary Benefit	4. Positivism, or Social Justice
5. Cost/Total Private Benefit	
6. Cost/Total Benefit	

Humane Growth Criteria

1. Improvements in efficiency, with no reduction in equity.
2. Improvements in equity, with no reduction in efficiency.
3. Improvements in both efficiency and equity.

These humane growth criteria limit policy changes quite severely to an area where efficiency and equity are complementary, consisting of a rectangle in Figure 3a defined by inefficient and inequitable point Z, point Y on the efficiency frontier, point X*, and the bliss

point Ω_1 representing optimum efficiency and justice. Specifically, the first humane growth criterion would permit changes in education budgets that improve efficiency along the extension of the line OZ, so that proportional equity under the same assumptions as before is undisturbed, as well as points toward Ω_1 from ZY. Criterion 2 would permit changes in educational finance that improve equity, moving from points along ZY toward X* Ω_1 in such a way that <u>efficiency</u> is not reduced. Criterion 3 consists of moves from Z toward the efficiency frontier <u>and</u> toward Ω_1 anywhere within this rectangle. Focusing only on student equity and lifetime redistribution, note that nowhere within triangle ZYΩ_1 is student A worse off in any absolute sense.

To go beyond this gets into the trade-off between efficiency and equity. Atkinson's equality measure, as developed by P. R. G. Layard and A. Walters (1978, p. 48) defines points along the iso-welfare function W_0W_0 in Figure 1 in such a way that the measure of inequality (in contrast to the Gini coefficient) is specifically related to the Welfare Function. Atkinson would define equally distributed equivalent lifetime earnings from education, X* in Figure 3a, as the earnings level that if everybody had it would generate the same level of welfare as the present distribution of real income at point Y; both are on the same welfare contour line. If average income happens to be at point Ω_1, then Atkinson's equality measure is defined as

$$E = \frac{X^*}{\Omega_1} \tag{4}$$

Social welfare increases if X* increases toward Ω_1, since Ω_1 is on a higher welfare contour. But similarly, social welfare increases if

the average benefit (or average income) Ω_1 increases due to improvements in efficiency by more than the measure of equality, E, falls since by rearranging (4):

$$X^* = E\,\Omega_1 \tag{5}$$

This is a theoretical framework for saying whether or not any given improvement in efficiency increases average lifetime income sufficiently to outweigh any adverse distributional effects. The point might be kept in mind when reading T. W. Schultz' contribution in Chapter 1. We can also say whether an inefficient policy of equalization is justified, which is relevant to the problem that arises when compensating school districts on equity grounds for the effects on children of their inefficient scale.

To make this efficiency-equity trade-off criteria operational requires using some specific welfare function, defining W_0W_0 in Figure 3b for example, as:

$$W_0 = \frac{1}{\alpha} y_A^{\alpha} + \frac{1}{\alpha} y_B^{\alpha} \quad , \qquad 0 < \alpha < 1 \tag{6}$$

This requires that the omniscient ethical observer, or the educational policy maker, or the researcher, must examine his ethical views and specify the alpha-weights.

If $\alpha = 1$, social welfare is the simple sum of lifetime earnings on total well being of A and B and we are indifferent to the distribution of earnings as in commutative equity. As $\alpha \Rightarrow 0$, $W_0 = \log y_A + \log y_B$, and a given number of dollars can accomplish a larger proportional increase if used to benefit the student who is currently worse-off in

terms of benefits until benefits are equal, approximately our equality-of-educational-opportunity equity criterion #3. Rawlsian positivism arises as $\alpha \Rightarrow -D$, with differing degrees of corrective action for the disadvantaged. An interesting example of a welfare function being applied verbally to current equity problems in school finance will be found in the contribution by Roe L. Johns in Chapter 11.

Complementarity. Humane growth criteria as defined above however emphasizes the opportunities for complementarity between efficiency and equity rather than the trade-offs. In fact, greater care is suggested where there are trade-offs because selecting the weights in the welfare function needed for appraising the relative value of efficiency and equity is more tenuous. There are of course points like Y in Figure 1 that are less efficient than point X, but are more equitable, and are to be preferred to point X, given that they lie above the level of welfare on which X is located. Furthermore, there are better opportunities for efficiency and equity to be improved jointly in education than in the economy as a whole where trade-offs are more inportant. This is because with young people, equality of opportunity may actually be a motivating force generating lifetime income where otherwise there would be none, and thereby translate into future work incentives. Whereas transfer programs among adults if carried too far involve trade-offs with efficiency.

Measurement. Measurement of humane growth criteria is merely in terms of measurement of the component efficiency and equity criteria.

Efficiency criteria up through level 4, monetary rates of return (e.g., Chapter 6) are extensively measured. The problem is to get to a total rate of return that includes non-monetary private and social

benefits. The first step toward this is to identify the non-monetary returns and to measure their relative importance, work that is well underway as indicated by Robert Michael's survey in Chapter 5. Next, ways must be explored of imputing a value to these, such as the exploratory steps in W. McMahon (1974) toward a total private rate of return. There are also other well known imputations based on opportunity costs such as those for the imputed rental value of owner occupied housing or the value of non-monetary job satisfactions that suggest a model. Imputations for social benefits will take longer, but eventually there may be a total rate of return for use as a total efficiency criterion.

Equity criteria currently are measured (focusing on student equity) largely in terms of the degree of inequality in expenditure per pupil. A promising approach would seem to be to extend this into a broader measure of the impact through education of the parents income and wealth on the students lifetime earnings and well being, which picks up the neighborhood effects on human capital formation explored by Charles Benson in Chapter 3. This kind of research, which is vital, together with research on the components, namely the relation of human capital formation to the lifetime income distribution later, is plunging ahead as seen in the excellent survey by Gian Sahota (1978, pp. 11-40) and is laying the foundations for a theory of distributive justice. The income distribution front of human capital theory in fact is currently riding the crest of the wave.

Once it becomes feasible to calculate a separate rate of return to investment in human capital that measures intergenerational equity

through the redistributive effect on lifetime income and lifetime well-being, the rest is simple. If this rate of return reflecting distributive justice, and a separate total return in terms of efficiency from any given investment were both positive, there would be complementarity between efficiency and equity as we have defined it here. In the meantime of course more informal judgments about movements toward humane growth must suffice.

Some Examples. Improvements in equity can sometimes not only fail to impede efficiency, but might even contribute to improvements in efficiency. One example may be what is peotentially an emerging empirical law of educational finance alluded to earlier. It indicates that as expenditure per pupil increases, decreasing percentages of the budget are spent on instructional staff and increasing percentages on other kinds of staff. This pattern found in higher education by Howard Bowen in Chapter 7 and among local school districts by Steven Carroll in Chapter 14 suggests that when the extra dollars per pupil are not spent to improve the quality of instruction and research, equalization can reduce waste and improve efficiency in the use of these dollars.

An example of the intergenerational complementarity between equity and efficiency specified by Humane Growth Criterion 3 might be found in special education for unemployed teenagers and drop outs. Opportunity costs of the students' time are low, so the total rate of return is high. It is redistributive since the parents in question are unlikely to finance it, and the future income of the otherwise less successful student is increased the most. There are social benefits in the form of cost savings in the short run for crime reduction and in longer run welfare costs.

Examples of how improvements in efficiency can improve equity, Criterion 1 or 3, are offered by T. W. Schultz in Chapter 1, who points to the waste in administration and organization of the overgrown metropolitan school systems.

Finally, there is an automatic contribution of efficiency in investment to intergenerational equity. This occurs as rates of growth of investment in human capital exceed rates of growth of investment in physical capital, presumably in response to the higher total rates of return on human capital. Since income from property and physical capital is a major source of inequality, the increasing relative importance of income from human capital gradually reduces some of the inequality in the distribution of income.

Dynamic Aspects and Optimization. Although past rates of return and measures of inequality or inequity are often a pretty good guide to what these will be in the near and intermediate future, caution is essential because they are not perfect forecasts. Job markets can change secularly due to technological discoveries or changing birth rates, and the income distribution forecast can also change as a result, so that some thought as to what these will be in the future is essential. Criteria based on current and past data are not always misleading, but must be used with some thought to the future and with care in budget planning.

Optimization techniques such as the goal programming applied by Elchanan Cohn in Chapter 13 combining efficiency and equity offer considerable promise. They do require specification of an objective function analogous to the welfare function discussed above that contains distributive justice weights. If the objectives were the returns or benefits of education expressed in value terms, and including

equity weights, the first order conditions in this education optimization/cost minimization framework could also be interpreted as a very closely related type of humane growth criterion. But these models also need to contemplate the effects of dynamic optimization, as well as the effects of external forces in the future, again commending caution in the use of the results.

A Theory of Educational Finance

The theory of educational finance set out above, although not set out formally in equation form and solved, does contain the necessary elements. They are--for the objective function--the returns to education which include non-monetary returns and the equity criteria to be applied toward the attainment of distributive justice. For the constraints necessary to the constrained optimization the elements are the production function relationships which allow for the role of the parents and neighborhood effects, and the investment cost constraints. The concept of human capital formation is a great aid to specification and measurement in an internally consistent way of the total ultimate returns to education, the full costs, and the intergenerational effects on the income distribution, while demonstrating significant explanatory power as shown in Chapters 5 and 6. Human capital concepts, in contrast to the screening and credentialling effects which overlap the effects of human capital formation to a significant extent and describe more limited phenomena, also are taking educational finance into a new era. So for these reasons we have chosen to given them a significant role in this theory of educational finance.

The hierarchy of efficiency criteria and the hierarchy of equity criteria may prove useful as the pressures for efficiency from taxpayers through tight budgets continues, and as the awareness of continuing student inequity spreads. But beyond this, the theory of educational finance combines emerging measures of non-monetary private and social benefits as essential to efficiency, and criteria for intergenerational equity as necessary to distributive justice, in a more comprehensive approach toward humane growth.

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Footnotes

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[1]For readers not familiar with isoquants, more detailed explanations are available in Henderson and Quandt (1971, 58-62, 89-91) or any other standard microeconomic theory text.