Cost-benefit analysis in educational planning

Third edition

Maureen Woodhall

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Fundamentals of educational planning

The booklets in this series are written primarily for two groups: those engaged in -- or preparing for -- educational planning and administration, especially in developing countries; and others, less specialized, such as senior government officials and civic leaders, who seek a more general understanding of educational planning and of how it can be of help to over-all national development. They are devised to be of use either for private study or in formal training programmes.

The modern conception of educational planning has attracted specialists from many disciplines. Each of them tends to see planning rather differently. The purpose of some of the booklets is to help these people explain their particular points of view to one another and to the younger men and women who are being trained to replace them some day. But behind this diversity there is a new and growing unity. Specialists and administrators in developing countries are coming to accept certain basic principles and practices that owe something to the separate disciplines but are yet a unique contribution to knowledge by a body of pioneers who have had to attack together educational problems more urgent and difficult than any the world had ever known. So other booklets in the series represent this common experience, and provide in short compass some of the best available ideas and experience concerning selected aspects of educational planning.

Since readers will vary so widely in their backgrounds, the authors have been given the difficult task of introducing their subjects from the beginning, explaining technical terms that may be commonplace to some but a mystery to others, and yet adhering

to scholarly standards and never writing down to their readers, who, except in some particular speciality, are in no sense unsophisticated. This approach has the advantage that it makes the booklets intelligible to the general reader.

Although the series, under the general editorship of Dr. C. E. Beeby of the New Zealand Council for Educational Research in Wellington, has been planned on a definite pattern, no attempt has been made to avoid differences, or even contradictions, in the views expressed by the authors. It would be premature, in the Institute's view, to lay down a neat and tidy official doctrine in this new and rapidly evolving field of knowledge and practice. Thus, while the views are the responsibility of the authors, and may not always be shared by UNESCO or the Institute, they are believed to warrant attention in the international market-place of ideas. In short, this seems the appropriate moment to make visible a cross-section of the opinions of authorities whose combined experience covers many disciplines and a high proportion of the countries of the world.

(Reprinted from the first edition of this booklet, 1970)

Foreword

In the mass of writing on educational planning over the past decade no topic has incurred the suspicion of teachers and administrators more than cost-benefit analysis. To be sure, they accepted gladly enough the economists' conclusion that education is a good investment -- they were already convinced of that without the benefit of mathematical models -- but they shied away from the corollary that, in the competition for limited funds, the effectiveness of education might be compared with that of new roads, fertilizers, or factories, and they vehemently insisted that the most important products of education must continue to slip through any economic net, however cunningly woven. The economists did little to allay their fears, they were so busy arguing about the subject amongst themselves that they had little time to explain what it was all about in language intelligible to the teacher.

This booklet is intended to bring the practising educationist into the picture, through some economists will also read it with interest. It begins with almost deceptive simplicity but goes on to discuss some of the difficult problems that have worried the economists themselves -- and without recourse to jargon. Whatever lingering suspicions the educationist may have of Maureen Woodhall *qua* economist, after reading this essay he cannot fail to admire her as a teacher; we were fortunate in getting her to explain one profession to the other. She makes no exaggerated claims for the techniques she expounds; she insists that cost-benefit analysis 'cannot be the sole criterion for educational planning but that such an analysis should be an important element in decision making... All planning consists of a

choice between alternatives. If cost-benefit analysis does no more than serve as a reminder of this truth, it will have practical significance.'

Any educational administrator who ignores this truth in the future will be asking for trouble. Particularly in developing countries, the allocation for education over recent years has absorbed an increasing proportion of the national budgets, and ministers of finance are the last persons to forget that there are attractive alternative ways of spending the nation's money and that the economists have offered them a tool, however rough, that is said to measure the effectiveness of different forms of expenditure. So the administrator who presses for increased finance for the schools must be prepared to support his case with arguments more sophisticated-both economically and socially -than many of us have employed in the past. Knowing the sweeping assumptions that lie behind some numerical statements of both costs and benefits in education, the administrator may on occasion suspect the arithmetic of the conclusions, but the reasoning behind the formulae is not so open to question, and the sooner he tries to master it the better, because he is likely to meet it increasingly often in his official life. This booklet may be of help to him.

Miss Woodhall graduated in philosophy, politics, and economics at Oxford, and is now Research Officer in the Research Unit in the Economics of Education at the University of London Institute of Education. During 1969 she was Associate Staff Member in the IIEP where she lectured and assisted with the current research project on cost analysis. She helped with the preparation of the UNESCO International Conference on Educational Planning and with the writing of the report. She has contributed articles to economic journals, and has collaborated with Mark Blaug in a number of papers and books (the latest, *The causes of graduate unemployment in India,* 1969) on the economics of education.

C. E. BEEBY
General editor of the series

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Contents

1. Introduction: the purpose of cost-benefit analysis

Education is now universally recognized as a form of investment in human beings, which yields economic benefits and contributes to a country's future wealth by increasing the productive capacity of its people. Thus expenditure on education can be partially justified in terms of the potential contribution of education to economic growth. But this immediately raises many questions. How does education compare with other forms of national investment? Which makes the greater contribution to future economic growth, investment in human capital or investment in physical capital? Are all forms of education equally productive? Is education a profitable form of investment for the individual as well as for society, and if so, do pupils and students, or their families, take this into account when making educational and occupational choices? All these questions revolve round one basic issue: the relationship between the costs and the benefits of education, viewed as a form of social or private investment. This booklet is concerned with the theory and techniques of cost-benefit analysis as applied to education, and with the relevance of cost-benefit analysis for educational planning.

It is written from the point of view of educational planners and administrators in developing countries, and its emphasis is fundamentally practical. It is of course necessary to give a brief summary of the economic theory underlying the concepts and techniques of cost-benefit analysis, and to examine some of the theoretical objections that have been made to applications of cost-benefit analysis to education. But theoretical reviews of

cost-benefit analysis are available elsewhere; the purpose of this booklet is to examine the practical significance of cost-benefit analysis for educational planning, and to provide a simple explanation of the technique for non-economists who are faced with economic problems of resource allocation. A major part of the booklet will be devoted to the practical problems of collecting and analysing the data necessary for a cost-benefit calculation. Actual examples will be given of cost-benefit exercises in developing countries. The booklet concludes with a discussion of the policy implications of cost-benefit analysis of education.

The term 'cost-benefit analysis' implies a systematic comparison of the magnitude of the costs and benefits of some form of investment, in order to assess its economic profitability. All forms of investment involve a sacrifice of present consumption in order to secure future benefits in the form of higher levels of output or income. Cost-benefit analysis (or rate-of-return analysis, which is the type of cost-benefit analysis most frequently applied to education) provides a means of appraising these future benefits in the light of the costs that must be incurred in the present. The purpose of the analysis is to provide a measure of the expected yield of the investment, as a guide to rational allocation of resources. Thus any private businessman who is contemplating investing in physical machinery must make a cost-benefit calculation to assess the likely profitability of the investment. In recent years economists have paid increasing attention to the application of cost-benefit analysis to public investment, and sophisticated techniques have been developed for measuring the costs and benefits of, for example, water resource and transport projects. Such projects are clearly analogous to private investments in physical capital and it is not surprising that techniques that are useful to the businessman should also prove useful to governments in making investment decisions.

A more recent development is the extension of cost-benefit analysis to the whole field of investment in human capital: education, on-the-job training, and health expenditures, to give the most obvious examples. Here an immediate problem arises. The future benefits from such investment include non-economic

benefits, and even the economic benefits are difficult to quantify. Because cost-benefit analysis is an economists' tool, designed to provide an economic appraisal of an investment possibility, applications of cost-benefit analysis to education focus strongly on the economic benefits of education. Consequently, some educationists have argued that cost-benefit analysis is inapplicable to education, because of the multiplicity of educational objectives, and the importance of non-economic benefits. However, once it is recognized that investment in education does produce significant economic benefits, the need to analyse the nature and magnitude of these benefits in relation to costs must also be recognized, even though this concentrates on only part of the total picture. In view of the importance which planners in developing countries now attach to the goal of maximizing economic growth, it is extremely important to have some means of assessing the economic impact of education. This does not mean that the social, political and cultural consequences of education are unimportant, but that cost-benefit analysis in its present form does not provide an appropriate means of analysing these consequences.

In the past, a few writers have discussed cost-benefit analysis of education as though this were a panacea for all problems of resource allocation in educational planning. Others have rejected the approach entirely, as of no value whatever for educational planning. It is not the purpose of this booklet to present cost-benefit analysis of education as a superior alternative to other approaches to educational planning, or to suggest that cost-benefit analysis alone can provide the answer to all problems of planning. Rather its aim is to show that cost-benefit analysis can provide the educational planner with vital information about the links between education and the labour market, and about the economic consequences of alternative educational policies.

Cost-benefit analysis of education, as currently practised throughout the world, can be criticized. For example, the common neglect of indirect economic benefits, as well as non-economic benefits, and the use of cross-section data which reflect present and past supply and demand conditions, raise some doubts about the usefulness of cost-benefit analysis as a guide to future policy decisions. Such objections will be examined in the booklet to see

whether they are fatal to the approach as a whole, or whether they can be overcome. At the same time, the booklet seeks to emphasize the strength of cost-benefit anaysis of education: namely, that it combines, in a convenient form, information about the costs of different kinds of education, together with information about the balance between the supply and demand for different categories of educated manpower. Cost-benefit analysis also serves to focus attention on certain key variables in a country's educational or economic system, namely relative costs of different types of education and relative earnings of different categories of manpower. Thus, although cost-benefit analysis may not always provide planners with unambiguous policy directives, it does provide them with information useful for making rational policy decisions. It is hoped that readers may judge its usefulness for themselves after reading this booklet.

2. Measurement of costs

The words 'cost of education' are often loosely equated with 'expenditure on education'. For purposes of cost-benefit analysis of an investment, however, it is necessary to define costs in terms of the total *opportunity cost* of a project, that is, all real resources that are used up by the project. These are called the 'opportunity cost' since every investment represents the sacrifice of alternative opportunities to use the resources, either for present consumption or for some other form of investment. Thus money expenditures are significant only because they represent the purchase of teachers' labour, school buildings and equipment, or other goods and services which have alternative uses. At the same time the educational system uses up other resources which have alternative uses, even though these are not reflected in normal expenditure on education. The most obvious example is the time of pupils and students themselves, who deprive the labour market of their services by choosing to continue their education. This represents a loss of productive capacity, and thus a loss of current output for the economy as a whole, as well as a loss of earnings for the individual. This opportunity of current output or income is foregone in the expectation that education will increase the productive capacity of the students in the future and hence future output. However, this loss of present income must be counted as one of the opportunity costs of education, since it does represent a sacrifice of real resources, even though the time of students is not reflected in actual expenditure, and thus appears at first sight to be a 'free' good. Similarly, other apparently 'free' goods or services used in the educational process do in fact represent a sacrifice of alternative opportunities. For example, in developing countries

the land and even the buildings for a school may be donated by the local community. However, these buildings or land may have alternative uses, and the decision to build a school may mean the sacrifice of an opportunity to build a hospital or community development centre. For budgetary purposes, donated land may be ignored; but for purposes of a cost-benefit calculation, which attempts to evaluate the profitability of one particular form of investment in comparison with alternative investments, it is essential that the sacrifice of alternative opportunities to use land or buildings should be counted as part of the real cost of the investment.

Thus, the measurement of the costs of education, for purposes of cost-benefit analysis, involves more than a simple calculation of money expenditures. It involves an attempt to estimate the total cost of investment in education, in terms of alternative opportunities foregone either by society as a whole, or by the private individual.

If the purpose of the cost-benefit analysis is to evaluate education as a form of social investment, the relevant cost concept is the total resource cost of education to the economy. This includes the value of teachers' time, books, materials and other goods or services, the value of the use of buildings and capital equipment, and finally the value of students' time, measured in terms of alternative uses.

The simplest measure of the value of teachers' time is expenditure on salaries. If for some reason, however, teachers are paid less than the current market rate for their services, some attempt must be made to estimate the true opportunity cost of their time. For example, in some developing countries teachers give some of their time free for adult literacy classes. If this time would otherwise have been unoccupied there is no opportunity cost to be measured, but if the time would otherwise have been devoted to some form of community development work, then the time has an alternative use and is not, strictly, a 'free' good. Similarly, if teachers are required by law to serve for a year at reduced rates of pay as a form of 'national service', the value of their time should be measured by market rates rather than actual salaries.

The value of books, stationery, and writing materials, can also be measured in terms of money expenditure. In some countries books are financed out of public funds, and provided free, or at a subsidized price. In this case the appropriate way to measure their cost is by public expenditure on books or materials. But in other countries pupils and students are expected to buy their own books. In such cases, some estimate of private expenditure on books is needed, because variations in methods of financing purchases make no difference to the true economic cost of the goods.

It is usually fairly easy to obtain estimates of annual current expenditure on salaries and purchase of materials. It is more difficult to estimate the annual value of buildings and equipment. If the buildings are rented, the annual rent can be used to represent the value of the capital resources used during the year. However, in most cases buildings are not rented, and so some estimate is required of the annual value of the use of capital, that is to say an annual rent must be imputed for the buildings or equipment. The simplest method of allowing for the costs of capital services is to calculate the annual amortization of the building, over its expected life. Amortization represents not only the annual depreciation of the building and equipment, but also a notional payment to cover interest charges, and therefore provides a good measure of the imputed annual rent of a building. At first sight it might appear that a simple depreciation calculation would be sufficient. However, this would be to ignore the fact that buildings are financed, in a single year, by investment funds, while their services are enjoyed over a number of years, and that the decision to build a school means a sacrifice of alternative opportunities to use the investment funds in order to earn interest. Once again, we are concerned to measure the cost of using educational buildings in terms of the alternative opportunities foregone.

Finally, the opportunity cost of students' time must be measured, in terms of the earnings foregone by students when they continue their education, rather than enter the labour force. These foregone earnings represent a real cost to the individual and, in the case of social costs, are a proxy measure for the output foregone by society. Some readers may be puzzled by the fact that this

definition of the cost of education includes both actual money expenditure, such as teachers' salaries, and notional items, such as imputed rent for buildings, and foregone earnings. In fact, all items are alike in being approximate measures of the opportunity cost of physical resources. Teachers' salaries are no more a real cost than foregone earnings, since both are no more than a proxy measure of the value of teachers' or students' time in alternative use. This is what is meant by saying that 'in a fundamental sense all costs are opportunity costs'.[1]

There are, of course, considerable problems involved in measuring the opportunity cost of students' time; it is necessary, for example, to take account of unemployment when measuring earnings foregone. However, the practical problems of measurement should not obscure the need to find some measure, however approximate, of the value of real resources. It is also worth emphasizing that estimates of opportunity costs make sense only within a given institutional framework. For example, if all universities were suddenly closed, the resulting flood of students on to the labour market would lower the wages of all young workers. But similarly the sudden need to find alternative uses for teachers, buildings and equipment, would disrupt the entire wage and price structure of the economy. The concept of opportunity cost and the technique of cost-benefit analysis are not, however, applicable to situations where a total change in the entire educational or economic structure is contemplated. It will be emphasized below that cost-benefit analysis is essentially a technique *of marginal analysis*. Similarly, the concept of the opportunity cost of an investment is meaningful only if the project does not, in itself, transform the alternative uses to which the resources could be put.

1. M.J. Bowman, 'The costing of human resource development', in *The Economics of Education*. Proceedings of a conference of the International Economic Association, edited by E.A.G. Robinson and J.E. Vaizey, New York: St Martin's Press; London: Macmillan, 1966, p. 423. This paper, pp. 421-450, and the discussion that follows its presentation, pp. 689-708, provide a good explanation of the opportunity cost concept, and a review of the problems of measuring opportunity costs, as opposed to money outlays.

If the purpose of a cost-benefit analysis is to evaluate education as a form of investment for the individual, the relevant costs are those borne by the student or his family. If fees are charged, these must be included, together with expenditure on books and other direct costs such as travel. Once again, indirect costs must also be included, in the form of earnings foregone. If students receive scholarships from public funds, to cover fees or maintenance costs, the average value of such scholarships must be subtracted from the total estimate of private costs.

Table 1 summarizes the elements of total social and private costs of education.

Table 1. Social and private costs of education

Social costs	Private costs
Direct	
• Teachers' salaries	• Fees, minus average value of scholarships
• Other current expenditure on goods and services	• Books, etc.
• Expenditure on books, etc.	
• Imputed rent	
Indirect	
• Earnings foregone	• Earnings foregone

These cost elements can easily be combined to give an estimate of the annual cost per student of each level or type of education. If there were no wastage or repetition this would be sufficient for a cost-benefit calculation, but where wastage rates are high, an entirely false impression would be given by a calculation based simply on annual costs and the normal length of a course. For whether we are considering education as a social or a private investment, allowance must be made for the fact that some students do not complete a course while others repeat parts of the course, in order to gain a qualification. Ideally, separate

cost-benefit calculations should be made for drop-outs, repeaters and those who complete a course in the minimum time. For despite the implications of the word 'wastage', it is likely that even an uncompleted course may yield some economic benefits which must be compared with the costs of one or two years' education. In fact, most countries do not have data which permit measurement of the benefits associated with part of a course, so the simplest solution is to calculate the average length of courses, allowing for drop-outs and repeaters, and to use this as the basis for the calculation of total costs, rather than the minimum or 'normal' length of courses. This will give the total cost which must be borne by society in order to produce a qualified student, or the average cost to the individual, after allowance for average rates of repetition and wastage.

3. Measurement of benefits

To evaluate education as an investment we need a measure of education's expected contribution to future levels of income or output. The obvious way in which education contributes to future income is by imparting skills and knowledge to educated manpower, thus improving the productivity of labour. If the productivity of educated workers is higher than that of the uneducated, this will be reflected in increased output, and in higher earnings for the educated. We therefore need an estimate of the additional lifetime earnings of educated workers. Ideally, these data should be collected by comparing the earnings of educated and uneducated workers over their whole working lives. The total lifetime earnings differential would then provide an estimate of the higher productivity of the educated.

Unfortunately, few countries have time-series data on the earnings of samples of educated and less educated workers, and the collection of such data would be difficult and time-consuming. The standard way of measuring benefits is, therefore, to use cross-section data to estimate average age-education-earnings profiles for workers with different levels of education. This means that instead of using data for a sample of workers collected over their whole working lives, we use data for a sample of workers of different ages, collected at one single time. Whereas genuine time-series data would show the earnings of a sample of workers, in each successive year, and thus an age-earnings profile for the whole of a working life, the cross-section data show the current earnings of workers of successive ages, and thus an

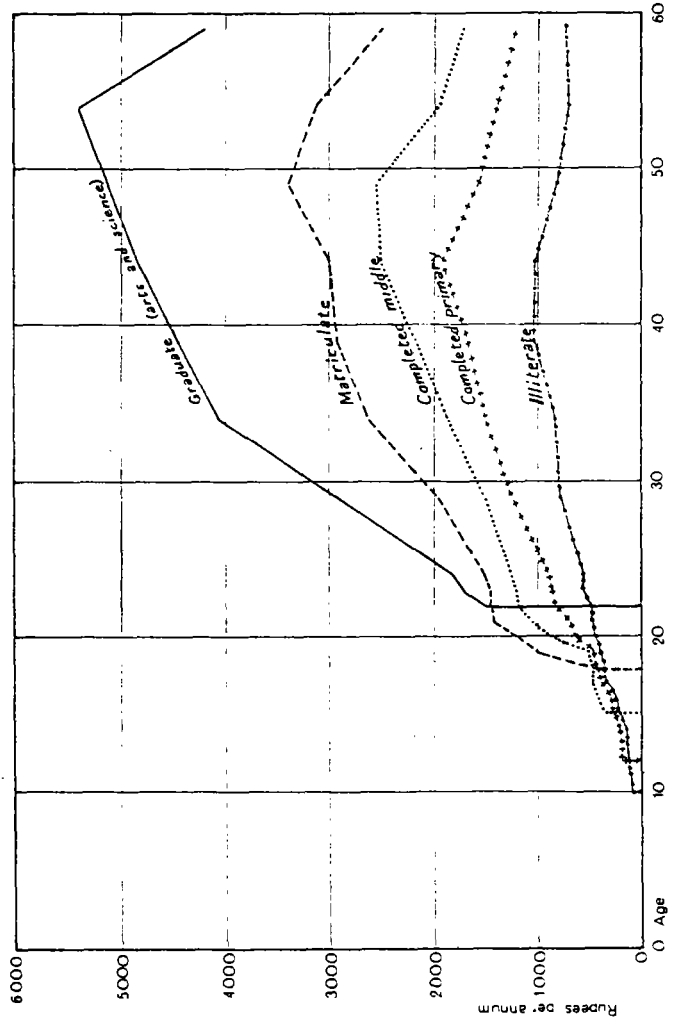
average lifetime age-earnings profile. The assumption underlying this technique is that in the future the earnings of a worker at age 30 will bear the same relation to his earnings at age 20 as the relationship now observed between the current earnings of a 30-year-old and a 20-year-old worker.

Figure 1 shows the average age-earnings profiles of five groups of educated workers in India in 1960-61. Such age-earnings profiles have now been constructed, on the basis of cross-section data, for at least 60 developed and developing countries.[2] This experience shows that typical age-earnings profiles have the following characteristics: (a) earnings are highly correlated with education; at every age the highly educated earn more than workers with less education, (b) earnings increase with age up to a peak at middle age and then flatten or even decline, up to the age of retirement; (c) the profiles of highly educated workers are steeper than those of the less educated; the peak earnings of an educated worker are higher, in relation to initial earnings, than the peak earnings of the less educated; (d) the age at which earnings reach their peak is later for highly educated than for less-educated workers; in a few cases the earnings of highly qualified manpower continue to rise until retirement.

If age-earnings profiles are available for two categories of workers, for example graduates and workers with no higher education, these can be used to calculate the lifetime earnings differential of the average graduate, that is the total additional income received by a graduate through his working life. It is this lifetime earnings differential that is used as a measure of the direct economic benefit of education for cost-benefit calculations.

2. See George Psacharopoulos "Returns to Education: A further international update and implications" *Journal of Human Resources*, Vol. 20, No.4, 1985, pp 583-97 for a summary of the results of cost-benefit calculations for 61 countries. These results are discussed below in Section 10.

Figure 1. Age-earnings profiles: by level of education, urban India



Source: M. Blaug, R. Layard, M. Woodhall, *The causes of graduate unemployment in India*, Table 1.4.

If the purpose is to analyse education as a social benefit, the whole of this differential, measured before income tax, is the relevant measure; if, on the other hand, we wish to assess education as a form of private investment for the individual, then it is the benefit actually enjoyed by the individual that is relevant, namely the post-tax differential.

This brief summary of the now standard way of measuring the benefits of education leaves many questions about the validity of the approach unanswered. Many of the objections that have been made to cost-benefit analysis of education centre around the measurement of benefits, and these will be examined in some detail in Section 6.

4. Measurement of a discounted cash flow

Age-earnings profiles give an estimate of the annual earnings differentials associated with education. A cost-benefit calculation requires these earnings differentials to be combined into a single figure, representing the total monetary benefit to be derived from education, so that this can be compared with its cost. The simplest method would appear to to be to add together each year's additional earning power, but this would make no economic sense. For the costs of an investment must be incurred in the present in order to obtain income in the future, and the expectation of receiving money in the future is worth less, in the present, than a corresponding amount actually received in the present. This is not simply a case of 'a bird in the hand is worth two in the bush', but reflects the fact that a sum of money received today can be invested at a positive rate of interest, so that it will increase steadily and in time be worth very much more than its present value. The rate of increase depends, of course, upon the rate of interest at which it is invested; a sum invested at 10 per cent will double itself in just over seven years, whereas the same sum invested at 5 per cent will double itself in about fifteen years. Therefore, if funds can be invested at 10 per cent, the promise of a dollar in seven years' time is worth only half as much as a dollar today, and the promised sum must, therefore, be discounted. Just as the increase depends upon the rate of interest at which money is invested, so does the present value of a sum of money to be received in the future. The higher the rate of interest, or discount, the lower is the present value of money expected at a future date; and similarly the further ahead the promised date, the lower the

present value. This is illustrated in *Table 2*, which shows how quickly $1 will grow if invested at 10 per cent compound interest, and also the present value of $1 expected in the future, if the discount rate is 10 per cent.

Table 2. Compound growth and present values at 10 per cent rate of interest

Year	Amount to which $1 invested will grow at end of each year	Amount which $1 promised at end of each year is worth today
1	1.100	0.909
2	1.210	0.826
3	1.331	0.751
4	1.464	0.683
5	1.611	0.621
6	1.772	0.564
7	1.949	0.513
8	2.144	0.466
Etc.		

Table 2 can be generalized, as follows.

1. A sum of money (A), invested at a positive rate of compound interest (r) for *n* years, will grow to $A(1 + r)^n$ by the end of the period. Thus $1 invested for four years at 10 per cent grows to $ 1 $(1 + 0.10)^4 = 1.464$.

2. The present value of a sum of money (A), expected at the end of n years, when the discount rate is r, is $A/1 + r)^n$. Thus, $1 expected at the end of four years, at a discount rate of 10 per cent, is now worth $ 1 $/(1 + 0.10)^4 = 0.683$.

All cost-benefit calculations involve the discounting of future flows of income, since the purpose of the calculation is to compare the present value of expected future benefits with the costs of the investment, which must be incurred in the present. If the costs of the project are spread over a period of years these must also be

discounted so that all money values, whether negative (costs) or positive (benefits), are expressed in terms of their present value. The technique of measuring future streams of income in terms of its present value is called the 'discounted cash flow' technique, and is a common feature of all kinds of investment appraisal. The technique is simple, and involves no more than the calculation of the present value, at some given or assumed rate of interest, of the income expected in every future year; the present value of the entire lifetime income stream is then given by the expression

$$\sum_{t=1}^{n} \frac{E_t}{(1+r)^t}$$

where n is the life of the investment project, E is the expected income from the investment, r is the rate of interest and E, denotes the sum of annual benefits from year 1 to year n. The calculation of discounted present values is made by computer or calculated, or can even be computed manually, using tables showing the value of $(1+r)^{t+}$ (compound interest) and

$\frac{1}{(1+r)^t}$ (discount) for any value of r and t.

5. Rate of return on investment in education

Once the costs and expected benefits of an investment project have been measured, and have been discounted at an appropriate rate of interest, the essential elements of a cost-benefit analysis are available. All that is now needed is a simple means of summarizing the information so that the costs and benefits of alternative investments can be compared. There are three basic ways of presenting this information in a convenient form, firstly by means of a benefit-cost ratio, secondly by a calculation of the present net value of the project, and thirdly by calculating the internal rate of return of the investment. A benefit-cost ratio, as the name implies, simply measures the ratio of discounted future benefits to discounted costs, at a particular rate of interest, and the present net value of a project is the value of discounted benefits minus discounted costs. Both these measures of investment yield have been used to carry out cost-benefit analysis of education, but they are less frequently used to evaluate education than the third technique, rate-of-return analysis. The rate of return of any investment project is simply the rate of interest that equates the discounted present value of expected benefits and the present value of the costs of the project. In terms of the symbols used in the previous section, the rate of return is the rate of interest at which the present value of expected benefits, $\sum_{t=1}^{n} \frac{E_t}{(1+r)^t}$,

and the present value of costs, $\sum_{t=1}^{n} \frac{C_t}{(1+r)^t}$,
are equal, or in other words the rate of interest at which the difference between discounted benefits and costs is zero.
That is, $\sum_{t=1}^{n} \frac{E_t - C_t}{(1+r)^t} = 0$

All three forms of cost-benefit analysis share the basic characteristics of measurement and discounting of costs and benefits, and the presentation of this information in a single summary statistic. The main difference between them is that benefit-cost ratios and present net value calculations depend upon an assumed rate of interest, whereas the rate of return on an investment is independent of any assumptions about interest rates, and simply shows the rate of interest that equates costs and benefits. If a private firm wishes to assess the yield of an investment, it is a simple matter to use the firm's own borrowing rate as the discount rate for cost-benefit calculations ; the most profitable investment is then the project which has the highest benefit-cost ratio, or present net value, at the rate of interest which the firm must pay to obtain credit. Unfortunately, when we come to assess the yield of investment in education it is less obvious what rate of interest is appropriate. The relevant concept to compare with the yield of investment in education is the average alternative yield on public or private investment. Is this 10 per cent or 20 per cent ? This remains a matter of controversy, and the answer is likely to be different in different countries, and at different times.

The virtue of using the rate of return as a means of measuring the yield of educational investment is that the choice of an alternative rate of interest is not built into the calculation as it is in the case of benefit-cost ratios. It is possible to draw some conclusions from a cost-benefit analysis which show that the social rate of return to university education is 8 per cent, whereas the rate of return to primary schooling is 15 per cent, even if there is still uncertainty about the rate of return to alternative forms of social investment. For this reason, most examples of cost-benefit

analysis of education use the rate of return, and this booklet will concentrate on this particular type of cost-benefit analysis.[3]

To sum up the arguments of the previous sections: cost-benefit analysis of education consists usually of an attempt to measure the social or the private rate of return to investment in particular types or levels of education. The social rate of return measures the relationship between the before-tax lifetime earnings differential associated with a particular type of education, and the total social cost of that education measured in terms of its opportunity cost. This rate of return can be compared with the rate of return on other types or levels of education, or with alternative forms of social investment, to provide a measure of the economic profitability of educational expenditure by the state. Similarly, the private rate of return, which measures the relationship between after-tax earnings differentials and those costs that are borne by the individual, provides a means of assessing education as a form of private investment. Once again, it is possible either to compare the rates of return to alternative types of education, or to compare education with other forms of private investment, such as the purchase of equity shares.

This bald summary will undoubtedly raise many questions in readers' minds about the validity of such a measure of the benefits of education, the extent to which earnings differentials really are the result of education, and finally whether governments or individuals really do, or should, make educational decisions on the strength of assessments of economic profitability. The next Section will examine some of the objections that have been made to cost-benefit analysis of education, particularly to attempts to measure rates of return.

3. This section presents an extremely simplified version of the arguments for rate of return versus alternative forms of investment appraisal. A more detailed explanation of this point is given in M. Blaug, R. Layard, M. Woodhall, *The causes of graduate unemployment in India*, London, Allen Lane The Penguin Press, 1969, pp. 25-28.

6. Theoretical objections to cost-benefit analysis of education

Economists and educationists have raised a number of objections to cost-benefit analysis of education, particularly in developing countries.[4] These objections can be very briefly summarized as follows.

1. Earnings differentials reflect differences in the natural ability, motivation, social background, sex, occupation, non-formal education, etc., of workers, as well as differences of education, so that earnings differentials cannot be used as a measure of the pure benefits of education.
2. Education does not make workers more productive, but simply acts as a 'filter' or 'screening device', which enables employers to identify those with superior natural ability. Earnings differentials therefore reflect this screening or certification function of education, and employers tend to demand higher and higher educational qualifications, which leads to a waste of resources.
3. In addition, earnings differentials do not adequately measure differences in the productivity of workers, because of

4. For example, J. Vaizey, *The economics of education*, London, 1962; T. Balogh and P. P. Streeten, 'The coefficient of ignorance', *Bulletin of the Oxford University Institute of Economics and Statistics*, May 1963, reprinted in M. Blaug (ed.), *Economics of education: selected readings, Vol.* 1, Harmondsworth, Middlesex, Penguin Books, pp. 383-395 (Penguin modern economics) ; S. Merrett, 'The rate of return to education : a critique', *Oxford Economic Papers*, Oxford, Clarendon Press, November 1966.

imperfections in the labour market, so that differences in earnings do not provide a measure of the direct economic benefits of education.

4. Besides these direct benefits, education generates indirect, or 'spillover' benefits, that is to say education may raise the productivity of people other than the educated worker himself, and these benefits are not shown up in earnings differentials; nor are non-economic benefits reflected in earnings differentials.
5. Rate-of-return calculations assume full employment of educated workers, whereas many developing countries are experiencing unemployment of graduates and secondary school leavers.
6. Age-earnings profiles drawn from cross-section data, which provide the basis for rate-of-return calculations, reflect present and past demand-and-supply conditions, whereas it is future demand and supply that concern the planner; therefore, rates of return provide a poor tool for educational planning.
7. Private rates of return are meaningless because individuals do not make educational choices as though they were making a purely financial investment decision.

This appears to be a formidable list of objections, on the basis of which some writers have attacked and rejected the whole concept of cost-benefit analysis of education. The purpose of this section is to take each objection in turn, see whether it is valid, and whether it suggests that the whole concept of cost-benefit analysis of education should be abandoned or whether, less drastically, it suggests ways in which cost-benefit analysis must be modified in order to take account of specific problems.

Interrelationship between ability and education

Some of the earliest examples of cost-benefit analysis of education simply used the whole of the extra earnings of educated workers as a measure of the benefits of education. However, this is unrealistic, and certainly open to challenge. The fact that higher earnings are *associated* with education does not mean that the whole of the earnings differential of educated workers is

attributable to their education. Such workers are likely to be of superior ability and social background, to have different types of job, and to have received more on-the-job training than less-educated workers, so that it would over-emphasize the benefits of education to attribute all the extra earnings to formal education. Education tends to be highly correlated with a number of other factors, all of which help to determine earnings. However, some progress has been made towards isolating the pure effect of education on earnings, and research in several countries, including the USA, Sweden and Mexico all suggests that, even when some of these other factors are held constant, education alone has a strong effect on workers' earnings.

In the USA a large-scale multivariate analysis of a sample of workers attempted to measure the individual and combined effect of some of the factors that determine relative earnings, for example, sex, race, occupation, urban or rural situation, rank and performance in school, and education.[5] The conclusion of this study was that length of education was the single most powerful factor in explaining differences in earnings. However, this study did not entirely distinguish education and ability, which are very highly correlated, nor did it fully allow for the fact that length of education is itself correlated with personal characteristics, such as persistence, or strong motivation. Two further American studies throw some light on the question of the influence of ability.[6] One analysed the earnings of a sample of high school and university graduates who had been given intelligence tests at school, and this showed that even when intelligence quotient scores were held constant, there was a strong relationship between length of education and earnings. Another interesting study confined itself to a sample of brothers, with different levels of education, and this

5. J.N. Morgan, M.H. David, W.J. Cohen, H.F. Brazer, *Income and welfare in the United States*, New York, McGraw-Hill, 1962.

6. These and other studies dealing with the correlation between ability and education are well reviewed in G. Becker, *Human capital: a theoretical and empirical analysis, with special reference to education*, New York, Columbia University Press, 1964, pp. 79-90.

showed that brothers with more education had correspondingly higher earnings.

Similar evidence that education has an effect on earnings, even when differences in social class origins or 'ability' (defined in terms of scores in intelligence tests) are taken into account, exists for other countries.[7] A plausible explanation is that, while ability and home background are important, it is only *in conjunction* with additional education that they have a strong influence on earning power. On the other hand, these studies also demonstrate clearly that other factors such as ability, family background, or simply motivation, do have some effect on earnings which is distinct from the effect of education.

Thus, the question is not 'does education have an effect on earnings' but 'how much of the observed earnings differentials of educated workers is actually the result of their education?' The American studies mentioned above suggest that roughly two-thirds of earnings differentials of educated workers can be explained by their education rather than by other factors, such as ability. Because of this, many rate-of-return calculations have taken two-thirds of observed earnings differentials as a measure of benefits, simply by multiplying each differential by a coefficient of 0.66. (This has been called by some writers the 'ability adjustment' or 'alpha-coefficient').

The actual value of the alpha-coefficient is still, however, a matter for debate. An estimate of 0.7 or 0.8 is probably reasonable for the USA, but it has been suggested that the effects of natural ability may be stronger at some ages, or for some categories of educated workers, than others, so that different values should be attached to the alpha-coefficient for different calculations.

A greater problem is posed when we come to measure benefits of education in developing countries. Apart from a few studies of earnings functions there is very little evidence to

7. A survey of research in this area, which includes fitting earnings functions to data on earnings, in order to identify the effect of variables such as age, ability, and length and type of education, on earnings, is provided in G. Psacharopoulos, *Earnings and education in OECD countries*. Paris, OECD, 1975.

suggest whether natural ability or social class exert a stronger or a weaker influence on earnings in developing countries than in the United States. In these circumstances it seems best to make alternative assumptions about the proportion of earnings differentials which can be attributed to education, and to calculate a range of values of the rate of return to education, corresponding to 'strong' or 'weak' assumptions about the influence of education on earnings. The desirability of calculating alternative estimates of the rate of return, based on different assumptions of this sort, will be further discussed in sections 7 and 8 of the booklet. For the moment, it is enough to emphasize that the fact that earnings are related to other factors besides education does not represent an insuperable problem for calculating rates of return.

Education as a filter

The fact that it is difficult to disentangle the effects of education and natural ability has given rise to the idea that education simply acts as a filter, or screening device, for the labour market; which means that the important thing for the student is not what he learns during the education process, but whether or not he emerges with a certificate at the end of it. According to this theory,[8] the main purpose of education is to provide certification of the natural abilities, aptitudes and attitudes of students, which employers then use in selecting workers for highly-paid jobs.

The unfortunate result of this process of credentialism, according to the critics, is that it leads to a 'qualifications spiral' in which employers are constantly upgrading the qualifications that they demand for the most highly paid jobs, simply in order to preserve the screening function of educational qualifications, and at the same time, students are seeking higher qualifications simply in order to stay ahead of the race for these top jobs. The final result is simply a waste of scarce resources, since education is costly.

8. See, for example, K. Arrow, 'Higher education as a filter', *Journal of Public Economics*, July 1973.

There is a certain element of truth in this over-simplified picture, and it is probable that what one writer calls the 'diploma disease'[9] does lead to unproductive use of resources in some developing countries. But to argue the fact that employers use educational qualifications to help them to identify certain abilities and attitudes implies that education has no other function, apart from acting as a screening device, is to adopt an unnecessarily limited and narrow view of education.

The value of the screening hypothesis is that it reminds us that we need to know more about the ways in which education makes workers more productive. In particular, it emphasizes that education affects attitudes as well as imparting knowledge, and that it develops latent abilities as well as creating new skills. It is useful to be reminded of these facts, but none of them need be inconsistent with the idea that education is a form of investment.

Relationship between earnings and productivity

One of the basic assumptions of all cost-benefit analysis is that relative earnings reflect the relative productivity of workers. Some economists deny this. They point to rigidities in the labour market, to the strength of habit and tradition in determining wage rates, to the power of trade unions, or the importance of administered wages in the public sector, sometimes resulting in the persistence of archaic salary structures, particularly in developing countries, and argue that the pattern of earnings in an economy tells us nothing about the relative contributions of different workers to total output. This seems a rather exaggerated point of view. It would be absurd to deny that such factors do have some distorting effect on relative wages; that trade union bargaining power may artificially inflate wages in some sectors or that wages today may reflect the market conditions of the past. An obvious example is the fact that in some developing countries civil service salary scales still reflect the salaries that were paid to colonial administrators before the country achieved independence; a few private firms may practise 'conspicuous consumption' of

9. R.P. Dore, *The diploma disease*, London, Allen and Unwin, 1976.

graduates, employing them for prestige purposes while paying them more than their true economic value. Such factors would mean that earnings differentials overestimate the true social benefits of education. On the other hand, some workers, with particularly scarce and valuable skills, may be paid less than their real social value. All of this means that estimates of social rates of return must be interpreted with care. However, to argue that because of these distortions relative wages must be rejected completely as a measure of relative demand for different skills is too strong an assertion; it would involve, among other things, a total rejection of the price system throughout the economy.

It is not necessary to go so far. The central assumption of cost-benefit analysis is that the wage-and-price structure *reflects*, even though it is an imperfect measure of, the balance between supply and demand for different skills. If it is believed that certain categories of workers are paid significantly more or less than their real economic value -- what economists call their marginal productivity -- then it may be possible to construct 'shadow prices' which more nearly reflect the real productivity of workers, and use these as a basis for cost-benefit calculation. The ideal way to construct shadow prices for an economy is by means of a linear programming model of the economy, but the construction of such a model, and its application to cost-benefit analysis of education, is likely to be a mammoth task.[10]

10. Linear programming models are mathematical techniques for maximizing a function (which expresses a dependent variable in terms of a number of independent variables) subject to a set of predetermined constraints. The model can be used with many different values for the independent variables to show which set of independent variables yields the maximum value of the dependent variable, for example, total output or income. A number of these models have been constructed for different countries, and used to explore certain problems in educational planning, but the use of such models is beyond the scope of this paper. The interested reader should consult: OECD, *Mathematical models in educational planning*, Paris, OECD, 1967; I. Adelman, 'A linear programming model of educational planning: a case study of Argentina' in I. Adelman and E. Thorbecke (eds.), *The theory and design of economic development*, Baltimore, John Hopkins Press, 1966, S. Bowles, 'The efficient allocation of resources in education', in *Quarterly Journal of Economics*, Cambridge, Mass., Harvard University Press, May 1967.

One attempt has been made to construct shadow prices for educated labour in Greece, using a linear programming model, and the results used to calculate shadow rates of return to education, but so far, there are few rate-of-return calculations that use shadow prices rather than observed prices.[11]

However, a more simple solution to this problem of estimating the 'true' rate of return to education, where it is believed that wage rates do not adequately reflect relative productivities, is to calculate alternative rates of return, based on different assumptions about marginal productivities, and relative wages. Such analysis can demonstrate the effects of alternative wage structures on rates of return.

Spill-over benefits of education

Age-earnings profiles, which form the basis for rate-of-return calculations, do not reflect the indirect or 'spill-over' benefits of education, which economists call 'externalities' nor the non-monetary 'consumption' benefits of education, and some writers have rejected cost-benefit analysis on these grounds. The fact that education is valued for its own sake, and that people may demand education as a form of consumption, is no justification for ignoring or denying that education also adds to future income, and is a form of investment. Cost-benefit analysis concentrates upon the investment aspects of education, and upon the measurable economic benefits of education, but this does not imply a denial that education generates other benefits as well. The question of how much weight should be attached to these other benefits is partly a matter of public policy and partly a matter of fact. It is a matter of policy whether educational planning should give more weight to economic growth than to other objectives, and in the face of the multiplicity of educational objectives, cost-benefit analysis can provide no more than an analysis of the economic impact of education. This cannot be the sole criterion for

11. G. Psacharopoulos, 'Estimating shadow rates of return to investment in education', Madison, Wisconsin, in *Journal of Human Resources*, Winter 1970.

educational planning, but the 'investment approach to educational planning' rests on the belief that such an analysis should be an important element in decision-making.

The question of whether indirect economic benefits of education outweigh direct, monetary benefits is, on the other hand, a matter of fact, even though techniques for measuring indirect benefits are as yet very crude. Several writers have pointed out that education does yield indirect benefits; for example, workers with little education may find their own productivity increased by working in a team with highly educated workers; the education of one generation is likely to influence the achievements and productivity of the next generation ; the education of women has a significant effect on fertility and may increase future income through its effect on the birth rate in over-populated countries. Unfortunately, it is easier to specify such benefits than to measure them, although, in principle, they are measurable. Little progress has been made in identifying and measuring externalities or spill-over benefits, particularly in developing countries, although some work in the USA by Haveman and Wolfe (1984) suggests that conventional rate-of-return studies seriously under-estimate the economic benefits of education, and that externalities and 'non-market' effects are substantial.[12] However, for the moment we must admit that external benefits are positive, that no techniques yet exist for measuring them, and that social rates of return, calculated from earnings data, represent underestimates of the returns to education. This is important if we wish to compare the yield of education with other forms of social investment, although even here it is helpful to have first an estimate of the *direct* economic benefits of, for example, education compared with health expenditures. But if the purpose of cost-benefit analysis is to compare the profitability of two forms of education, the problem is less important. For while it is generally accepted that education generates external benefits, it is less obvious that, for example, higher education yields more indirect benefits than

12. R. Haveman and B. Wolfe, "Education and economic well-being: the role of non-market effects" in *Journal of Human Resources*, Vol. 19, No.3, 1984, pp. 377-407.

primary schooling. Thus, for purposes of comparing the returns to different levels or types of education, the fact that rates of return present underestimates does not necessarily introduce an important bias. This does not mean that externalities should be ignored, and in fact this represents one of the most important, but difficult, areas for further research.

Effect of unemployment on rates of return

Cost-benefit analysis of education in advanced countries generally ignores the problem of unemployment or non-participation among educated workers, but in developing countries, where educated unemployment may be a serious problem, and participation rates low, estimates of the social rate of return must take account of possible unemployment of the educated. It is perfectly possible to make such an adjustment when measuring social rates of return. The simplest way to do this is to measure benefits in terms of earnings adjusted for differences in the rates of employment and labour force participation of workers with different levels of education. If such data are unavailable, some estimate must be made of the average rates of employment for workers of different ages in each educational category, so that the benefits of education can be measured in terms of earnings weighted by the probability of employment for educated workers. An example of such a calculation for India will be given below.

Relationship between the present and the future

Objections to cost-benefit analysis on the grounds that present rates of return reflect past investment policies and thus provide a poor guide to the future must be examined at two levels. First, there is the problem that the rate of return measures the profitability of *past* levels of investment, in terms of the *present* relationship between supply and demand. The rate of return, as calculated, will serve as an estimate of *future* profitability only if the present relationship between supply and demand is maintained. Cost-benefit analysis is a form of marginal analysis, and the rates of return which we have discussed are marginal rates

of return, which measure the effects of a small increase in investment in education. This means that the rate of return to investment in education, calculated from current data on earnings, will not provide a good estimate of the profitability of a large-scale expansion of education designed to fundamentally change the balance between supply and demand for educated manpower. What cost-benefit analysis can do in those circumstances is to focus attention on the need to analyse the likely effects of a large-scale expansion on relative earnings; in other words, if the educational planner is contemplating non-marginal changes in the educational system, he must not assume that present rates of return will continue in the future, but try to predict the future pattern of earnings differentials in the light of a massive increase in supply. Because of this difficulty, some opponents of cost-benefit analysis have denied that rates of return serve any useful purpose for forward planning. However, any attempt to predict the future is likely to be improved by a thorough understanding of the present, and estimates of social and private rates of return can, therefore, be useful in providing information about the present balance between supply and demand. This information will be even more valuable if it is based on estimates of trends in rates of return over time. So far, the country with the most detailed historical data on age-earnings profiles estimates of rates of return over time, is the USA, but there is now evidence of changes in the earnings of educated workers over time in several developing countries as well as industrialized countries. G. Psacharopoulos gives estimates of average rates of return in the 1960s and 1970s based on 5 developed and 11 developing countries. This suggests that the average rate of return in developing countries declined from 20 per cent in the 1960s to 15 per cent in the 1970s, but was still above the average rate of return on physical capital.[13] Cost-benefit analysis of education, showing changes in rates of return to education over time, are still rare in developing countries but such data may become available in the

13. G. Psacharopoulos "Returns to Education: A further international update and implications" in *Journal of Human Resources*, Vol. 20, No.4, 1985.

years ahead. There remains the problem that age-earnings profiles based on cross-section data underestimate the earnings of workers in the future, because the workers will be employed in a developing economy, with rising levels of real income. This means that if no allowance is made for future growth of incomes, estimates of the rate of return will underestimate the financial returns from education in the future. Because of this, some writers have made an adjustment to rates of return calculated from cross-section data, corresponding to the assumed growth of real earnings in the future. Even so, this adjustment may under-estimate the growth of earnings in the distant future, which would mean that the rate of return would be biased downwards. Fortunately, this is not a source of serious bias because the process of discounting gives much less weight to future earnings than to earnings in the next few years. Therefore, rate-of-return calculations are less sensitive to inaccuracies in the measurement of benefits in the distant future than to inaccuracies in the early years of a man's working life.

The meaning of the private rate of return

Most of the objections that have been discussed so far relate to estimates of the social rate of return. A quite different objection is sometimes made to calculations of the private rate of return to education. It is argued that students choose education for a variety of reasons, not only vocational and financial ones; and to assume that students or their families make calculations of the private rate of return is to ascribe too great an influence to economic and financial factors. This objection misses the point of cost-benefit analysis. Estimates of the private rate of return are intended to measure how profitable it is for the individual to spend money on his own education, as a way of increasing his future earning power; they do not assume that this is the sole motivation for all educational decisions. Nevertheless, in developing and developed countries alike, students and their families are usually well aware of the vocational advantages of higher education, and the desire for a better job, and higher lifetime income, is frequently an important factor influencing educational choices. When students

make their decisions it is on the basis of fairly rough estimates of likely benefits, compared with costs. Calculations of the private rate of return show more accurately, and in greater detail, what the balance is between financial loss in the present and financial gain in the future. Thus, estimates of the private rate of return may throw light on trends in private demand for certain types of education or trends in the emigration of educated workers, even though the hypothesis that students choose education for investment purposes does not provide a complete explanation of student motivation.

We have come to the end of the review of objections to cost-benefit analysis. We have seen that some of the objections can be met by making statistical adjustments when calculating rates of return ; for example, adjustments must be made to allow for the proportion of earnings attributable to factors other than education, such as ability, to allow for the possibility of unemployment among educated workers, and to allow for the future growth of earnings. The following section examines the practical problems of calculating rates of return, including that of obtaining the necessary data, and methods for making the various necessary adjustments to rates of return.

But some of the problems we have mentioned cannot be solved simply by statistical adjustments. The final sections of this booklet deal with the question of interpretation of rates of return, in the light of the objections outlined above, and illustrate the practical uses of cost-benefit analysis with some actual examples.

7. Calculation of rates of return

The first practical problem of calculating rates of return, particularly in developing countries, is one of data collection. The following list represents data requirements in *ideal* circumstances: (a) data on the earnings of a representative sample of workers classified by age, educational level, including type of course as well as length of schooling, occupation, sex, social background, location of employment, and some measure of natural ability, such as scores in an intelligence test ; (b) data on current expenditure of educational institutions, by level; (c) estimates of the capital value of educational buildings and equipment, by level; (d) estimates of private expenditure on fees, books, stationery, etc., by level; (e) public expenditure on scholarships, by level; (f) average income tax rates; (g) data on labour market conditions, including rates of unemployment and labour force participation, by age, sex and educational level.

These data, if available, could be used to construct age-earnings profiles before and after tax, which are needed for both the cost and the benefit side of the calculation, and to provide estimates of the direct private and social costs of education. In practice, no country has such detailed information, but it is perfectly possible in most countries to obtain enough data to make rate-of-return calculations, even though certain gaps may have to be filled by making assumptions. The first essential is a sample survey giving details of the earnings (or, failing that, the incomes) of workers classified by age and education. Many of the

American cost-benefit calculations are based on census data, but few countries include questions on incomes and education in the census. However, sample surveys showing the earnings of workers do exist in many countries, and have been used to construct age-earnings profiles and to calculate both social and private rates of return in at least 36 developing countries, including 16 African countries, 10 in Asia and 10 in Latin America.[14] These calculations are often based on imperfect data, but nevertheless can be useful in providing preliminary estimates of the relative profitability of different levels of education.

Having dealt with the problem of data collection, we will now examine the successive stages of estimation and calculation needed for an estimate of social and private rates of return. Data on earnings by education and age provide average age-earnings profiles, which in turn provide estimates of the annual earnings differentials associated with education, and earnings foregone during education' If we are calculating social rates of return these pretax earnings differentials are sufficient to provide a measure of the benefits of education, after adjustments have been made to allow for the effect of ability and other factors on earnings, and to allow for unemployment. If we are measuring the private rate of return, it is necessary also to apply the prevailing income tax rates, to discover after-tax earnings differentials. *Table 3* illustrates this calculation, using data on the earnings of graduates and matriculates in urban India in 1960-61.[15]

14. See G. Psacharopoulos "Returns to Education: a future international update and implications" op. cit.

15. The following examples are drawn from: M. Blaug, R. Layard, M. Woodhall, *The causes of graduate unemployment in India,* op. cit. Further details about the calculations are given in the book.

Table 3. Calculation of social and private returns to higher education in urban India, 1960-61

Age	Average annual earnings of: Graduates (Rs. per annum)	Matriculates (Rs. per annum)	Pre-tax earnings differential of graduates	Post-tax* earnings differential of graduates
18	-	495	-	-
19	-	998	-	-
20	-	1 174	-	-
21	-	1 403	-	-
22	1 480	1 453	27	27
23	1 691	1 456	235	235
24	1 765	1 483	282	282
25-29	2 923	1 959	964	964
50-54	5 405	3 109	2 296	2 246
55-59	4 214	2 492	1 722	1 698

Note: * Obtained by applying the standard rate of income tax payable by a married man with two children; because of the low level of income tax levied in India, graduates and matriculates in the 18-30 age group do not, on average, pay tax, although they become liable to do so as their earnings increase with age.

Source: M. Blaug, R. Layard, M. Woodhall, op. cit., Table 7.1

Table 3 also shows the earnings of matriculates, aged 18 to 21, which represent the earnings forgone by students while they obtain a degree. These foregone earnings constitute one important element of both social and private costs of higher education. In addition, data are needed on direct social and private costs.

Table 4 shows estimates of direct social and private costs of higher education per student in India, derived from official statistics and estimation. Section (a) of Table 4 shows the annual costs of higher education. The minimum length of study for a degree is four years (two years to intermediate and two years to the degree). Section (b) shows the costs of higher education on the assumption that students require only the minimum time to obtain a degree. However, wastage and repetition rates are high in India, and section (c) of the table takes account of the fact that, on

average, it requires 6.9 years of teaching, instead of four years, to produce one graduate.

Table 4. Direct social and private costs of higher education per student, India 1960-61 (Rs per annum)

	Social costs Years		Private costs Years	
	1 and 2	3 and 4	1 and 2	3 and 4
(a) Annual cost:				
Current expenditure on teachers, etc.	302	494	-	-
Imputed rent	48	48	-	-
Expenditure on books	150	150	150	150
Fees minus average scholarship	-	-	106	227
(b) Total cost, excluding wastage	2 384		1 266	
(c) Total cost, including wastage	4 084		2 166	

Source: Derived from M. Blaug, R. Layard, M. Woodhall, op. cit., tables 8.10 and 8.11

The data shown in Tables 3 and 4 are sufficient for calculations of the social and private rate of return, after adjustments have been made for: (a) the proportion of earnings attributable to natural *ability;* (b) the probability of *unemployment;* (c) the expected *growth of incomes.* A fourth adjustment, for wastage, has already been incorporated into the estimates of cost shown in Table 4.

The ability adjustment consists simply in multiplying observed earnings differentials by a coefficient (the a coefficient) which corresponds to the proportion of earnings differentials attributable to education. Since there is no information for India which allows an accurate estimate of this proportion, the best solution is to carry out simple sensitivity analysis, by calculating rates of return on alternative assumptions about the value of the a coefficient. Three values were chosen for this calculation: $\alpha = 1$ (no adjustment), $\alpha = 0.66$ and $\alpha = 0.50$. In other words, rates of return were calculated using the whole observed earnings

differential as a measure of benefits, as well as two-thirds and half the observed differentials shown in Table 3.

Estimates of rates for India should also take into account the fact that, on average, matriculates have to wait for 1.4 years after matriculation in order to find their first job, and graduates wait 0.5 years. These figures were derived from two labour surveys which showed the proportions of matriculates and graduates unemployed during each of the seven years after they obtained their qualification. The earnings shown in Table 3 should be reduced to allow for the average period of unemployment, and this adjustment must be made when measuring both earnings foregone, on the cost side, and also earnings differentials, on the benefit side.

Finally, some allowance must be made for expected future growth of incomes which will increase absolute earnings differentials, even if relative earnings remain constant. The simplest means of allowing for this factor is to add the expected annual rate of growth of incomes to the estimates of the rate of return. So, for example, if a rate of return of 10 per cent is obtained from cross-section data on earnings, the addition of 2 per cent, which gives an estimated rate of return of 12 per cent, is equivalent to increasing all earnings during an entire working life by 2 per cent a year.

The data shown in Tables 3 and 4, adjusted to allow for wastage, unemployment, the earnings attributable to factors other than education, and future growth of incomes can now be combined into one single figure: the social or private rate of return to a university degree. This consists of three steps: (1) the calculation of a net returns stream (benefits minus costs); (2) the calculation of the present value of these net returns, at alternative discount rates; (3) the discovery of the discount rate at which the present value of the net returns is zero.

Table 5 illustrates this calculation of the social rate of return, using, in order to simplify the presentation, the figures shown in Tables 3 and 4, without any of the four adjustments.

The actual calculation of the rate of return involves nothing more than successive calculations of discounted net returns (E_t- C_t), using different discount rates, until the discount rate is

found at which the present value of net returns is zero. As the discount rate is changed, the value of the net returns stream changes from positive to negative ; Table 5 shows that the rate of interest at which the present value of costs is exactly equal to the present value of benefits is 12.7 per cent. This represents the social rate of return to higher education in urban India in 1960, with no allowance for wastage, unemployment, etc. The cumulative effect of each of these adjustments is as follows: (a) the wastage adjustment lowers the rate of return to 8.8 per cent; (b) the unemployment adjustment increases this to 9.6 per cent (since unemployment rates are lower for graduates than for matriculates) ; (c) the ability adjustment depends on the chosen value of α; if $\alpha = 0.66$, the rate of return is 6.9 per cent and if $\alpha = 0.50$. it is 5.4 per cent ; (d) the growth adjustment increases the rate of return to 8.9 per cent or 7.4 per cent (depending on the value of α).

Thus, as a result of these calculations showing the range of values we are able to say that the social rate of return to a university degree in urban India in 1960 was between 7 and 12 per cent, depending on critical assumptions about the effect of ability, unemployment, wastage and growth on future earnings.

TABLE 5. Calculation of the social rate of return to higher education in India

	Value of t (age of worker shown in brackets)	Net returns ($E_t - C_t$) (Costs (C_t) = negative benefits (E_t) = positive)	Discount factor $\frac{1}{(1+r)^t}$ $r = 10\%$	$r = 13\%$
$t = 1$	(18)	−995 (−495 −500)	0.909	0.885
$t = 2$	(19)	−1 498 (−998 −500)	0.826	0.783
$t = 3$	(20)	−1 866 (−1 174 −692)	0.751	0.693
$t = 4$	(21)	−2 095 (−1 403 −692)	0.683	0.613
$t = 5$	(22)	+ 27	0.621	0.543
$t = 6$	(23)	+235	0.564	0.480
$t = 7$	(24)	+282	0.513	0.425
$t = 8 \ldots 12$	(25-29)	+964	0.466	0.376
	...	...	...	...
$t = 33 \ldots 37$	(50-54)	+2 296	etc.	etc.
$t = 38 \ldots 42$	(55-59)	+1 722		

$$\text{At } r = 10\% \sum_{t=1}^{t=42} \frac{E_t - C_t}{(1+r)^t} \text{ is positive}$$

$$\text{At } r = 13\% \sum_{t=1}^{t=42} \frac{E_t - C_t}{(1+r)^t} \text{ is negative}$$

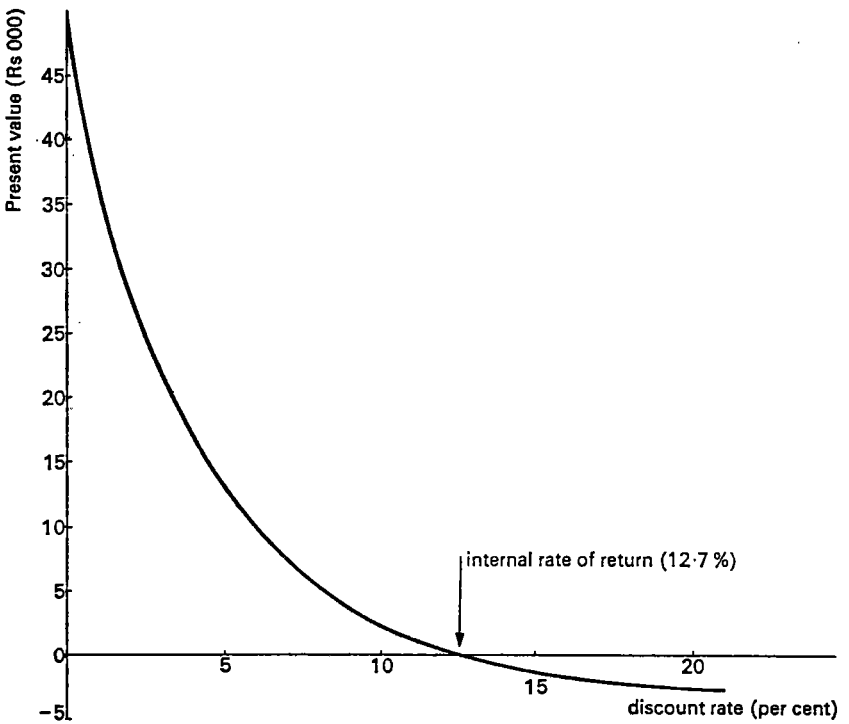
$$\text{At } r = 12.7\% \sum_{t=1}^{t=42} \frac{E_t - C_t}{(1+r)^t} = 0$$

8. Alternative methods of calculating rates of return

If data are available for the calculation of age-earnings profiles, the rate of return to different levels of education can be calculated, as described in the previous section, using either a computer programme or a simple calculator, discount tables and a process of "trial and error" by which alternative discount rates are used to calculate discounted net returns ($(E_t - C_t)$) until the rate of interest is identified which makes discounted costs equal to discounted benefits, and the present value of net returns is zero. This can be estimated graphically by plotting the present value of net returns on the vertical axis and alternative interest (discount) rates on the horizontal axis, as shown in *Figure 2*. The rate of return can be identified from this graph as the rate of interest (discount) at which the value of discounted net returns is zero and the curve crosses the horizontal axis (approximately 12.7 per cent).

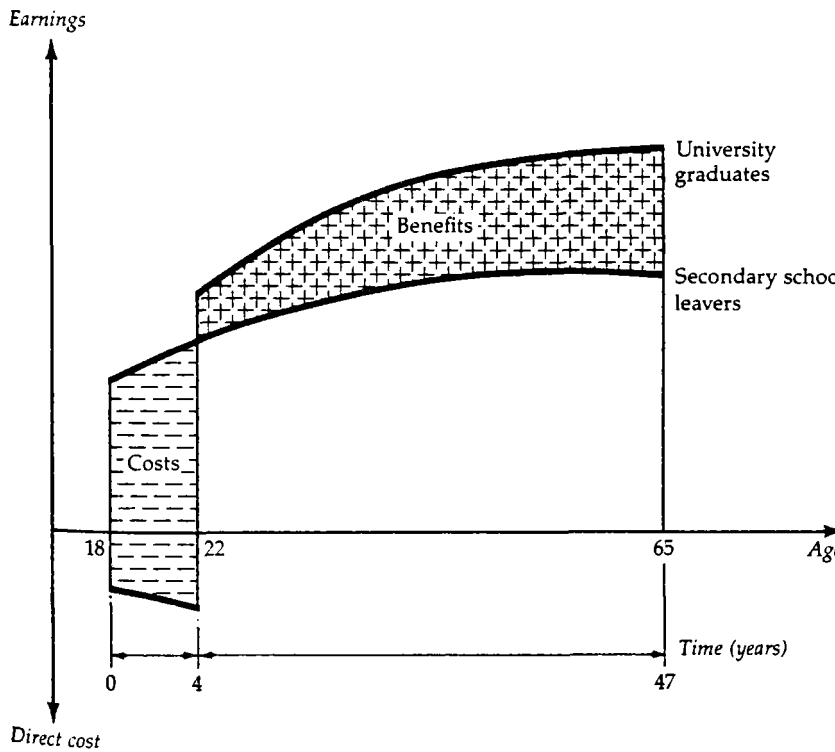
Some calculations of the rate of return to education use this method, which is sometimes described as the "elaborate" or 'complete' method of calculation. This is based on actual age-earnings profiles, shown in *Figure 1* on page 23 and data on the costs of education, including both direct costs and indirect costs (earnings forgone) as explained above. Age earnings profiles are used for the calculation of both benefits and costs, as shown in *Figure 3* which represents earnings differentials (benefits) as positive and foregone earnings (costs) as negative.

Figure 2. Discounted present value of net social returns to higher education in India



Source: Blaug, Layard and Woodhall, 1969, p. 213.

Figure 3. Age earnings profile for rate of return calculation using 'complete' method



Source: Mingat and Tan, p. 113.

In many cases, however, data are not available showing the earnings of workers of different ages and different levels of education, which are necessary for calculation of age-earnings profiles. Two alternative methods for estimating the rate of return have therefore been developed, and have been used in several studies in developing countries. One alternative method is based on the concept of an earnings function, and the other uses a 'short-cut' method which gives a rough approximation of the rate of return. These two methods are described below.

The concept of an earnings function was used by Mincer in 1974 to explain the pattern of individual earnings in the USA. Individual earnings may be influenced or determined by a variety of factors, including not only age, education, on-the-job training, occupation, the number of hours or weeks worked, urban or rural location but also in many cases personal characteristics such as sex, race or ethnic origins, social class or family background, language, and ability and motivation. Mincer used an earnings function to analyse the relationship between formal education (schooling), experience (including on-the-job training), and earnings of male workers in the USA. This involved testing the hypothesis that an individual worker's earnings are a function of variables including the length of schooling (S), and the number of years of work experience (EX).

The earnings function can be written in the form:

$$Y = f(S, EX)$$

and can be estimated using a multiple regression equation, specified in semi-logarithmic form:

$$\text{Ln } Y = a + bS + cEX,$$

where Ln Y is the natural logarithm of income (Y)
S is the number of years of schooling
EX is the number of years of work experience
a is a constant and
b and c are regression coefficients.

This form of an earnings function, sometimes described as a 'Mincerian function' since its use to analyse the pattern and determinants of earnings was first developed by Mincer (1974), is a simple one which assumes that earnings are determined only by two factors, amount of education (years of schooling) and work experience, but it is possible to estimate more complex earnings functions which incorporate additional variables, and there are now a number of studies in both developed and developing countries that estimate earnings functions using a variety of variables, including education, work experience and on-the-job training, as well as number of hours or weeks worked, urban/rural location and a variety of personal characteristics including measures of ability.

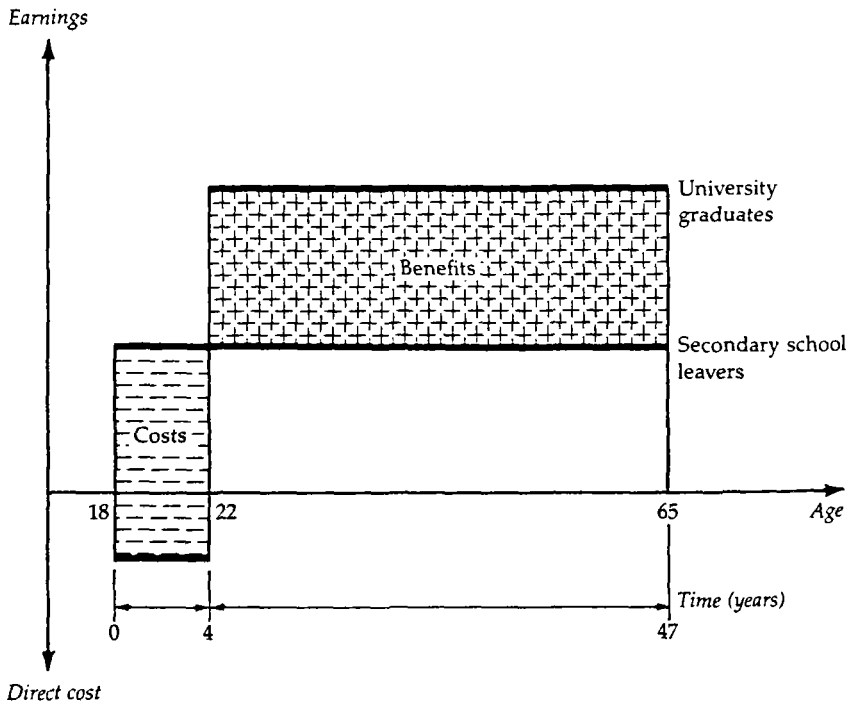
Earnings functions are useful in two ways for cost-benefit analysis of education. Firstly, an earnings function can be used to estimate the influence of different factors on earnings, including ability, social class background and other factors that are usually reflected in the *ability* adjustment (α coefficient) that is used in rate of return studies to measure the effect of education on earnings.

Age earnings profiles already measure the influence of two variables: level of education (which is measured simply by years of schooling in Mincer's original earnings function) and age (which can be treated as a proxy for years of work experience). The ability adjustment (α coefficient) can be regarded as a rough approximation of the influence of ability and other factors, such as social class, whereas an earnings function could be used to measure the influence of these factors more precisely.

The second way in which an earnings function can be used in cost-benefit analysis is to estimate the rate of return to schooling by using regression analysis, regressing data on earnings (Y) of a sample of workers, classified by educational level, on the number of years of schooling (S) to solve the equation:

$$\text{Ln } Y = a + bS.$$

Figure 4. Age-earnings profile for rate of return calculation using earnings functions or 'short-cut' method



Source: Mingat and Tan, p. 114.

Successive calculations of this equation, which assume specific values of S for different levels of education, for example primary education (S = 6), secondary education (S = 12) and higher education (S = 18), can be used to estimate the rate of return to primary, secondary or higher education, since Mincer demonstrated that the regression coefficients (b) can be interpreted as the average rate of return (r). This is based on a number of simplifying assumptions:

(i) The earnings differential associated with each level of education is constant throughout working life; in other words the assumed age-earnings profiles are flat, as shown in *Figure 4*, as opposed to the conventional shape of age-earnings profiles, shown in Figure 3.

(ii) Only indirect costs, or forgone earnings, are taken into account; the earnings function already incorporates earnings forgone, as shown in *Figure 4*.

Although these assumptions are not realistic, Psacharopoulos (1981) argues that they make little difference to the calculation and therefore that it is possible to use this method to estimate rates of return in the absence of the detailed data required for the 'elaborate' or 'complete' method. An even more simplified method is sometimes used, which is now known as the 'short-cut' method. This is used when no data are available for full calculation of earnings functions, but there are data showing the average earnings at one point in time of workers with primary schooling, secondary schooling and higher education, together with estimates of the annual cost of primary, secondary and higher education.

The short-cut method ignores the effect of age on earnings and assumes a flat earnings profile, as shown in Figure 4, which implies that the average earnings differential of graduates, or workers with secondary schooling, remains constant throughout their working life. The rate of return can then be estimated very approximately, using the formula:

$$r = \frac{[E\ (High) - E\ (Sec)]}{[n\ (E(Sec) + C]}$$

Where E (High) and E (Sec) represent the average earnings of university graduates (High) and workers with secondary schooling (Sec), n is the normal length (number of years) of secondary or higher education and C is the annual cost of secondary or higher education.

This formula can be used to estimate both the private and the social rate of return. For example, if we assume the following values, which are based very roughly on the Indian data used in the previous section:

Average earnings of graduates, E (High) = 2923
Average earnings of workers with secondary schooling,
E (Sec) = 1403 years of higher education, n = 4,
Annual cost of higher education, C = 2384

the formula for the social rate of return would be:

$$\frac{2923 - 1403}{4(1403 + 2384)} = \frac{1520}{15{,}148} = 10.0\%$$

This means that a rough approximation of the social rate of return to higher education, using this 'short-cut' method is 10 per cent, compared with a value of 12.7 per cent obtained from the 'elaborate' or 'complete' method, shown above. This is consistent therefore with the conclusion of the previous section that the social rate of return to a university degree in India is between 7 and 12 per cent, depending upon what assumptions are used.

Mingat and Tan (1988) compared the pattern of rates of return derived from the 'complete' and the 'short-cut' methods and concluded. "The estimates from both the "complete" and "short-cut" methods show that all corresponding rates [of return] have the same order of magnitude and that the structure of returns -- that is the way the rates relate to each other -- is basically the same whichever method is used. The rates of return are not completely accurate, but for assessing investment priorities in education, precise figures are not essential" (Mingat and Tan, p. 116-7).

9. Interpretation of rates of return

Having estimated that the social rate of return to higher education in urban India is between 7 and 12 per cent, what can we say about the profitability of Indian education? The first problem of interpretation is to decide with what alternative rate we should compare the rate of return on educational investment. Rates of return provide measures of *relative* profitability, and are meaningful only in comparison with estimates of the yield of alternative forms of investment. Thus, the planner may wish to use estimates of the rate of return to educational investment for several types of comparison: (a) to compare the relative profitability of education and other forms of social investment; (b) to compare the relative profitability of different types or levels of education; (c) to compare the social rate of return to education in one country with another; (d) to compare the relative profitability of education to society and to the individual, by comparing social and private rates of return; (e) to compare the rate of return to education at different points in time.

Some examples of cost-benefit analysis of education can be found corresponding to each of these categories, but the problems of interpretation are more difficult in some cases than others. For example, if the purpose of cost-benefit analysis is to compare the relative profitability of different forms of investment, it is important that the measure of benefits capture both external and direct economic benefits. If we wish to compare the economic

effects of increasing investment in education with investing in more medical care, we need some estimate of the external benefits of both forms of investment. But it is precisely at this point that cost-benefit analysis so far is weak; nobody has succeeded in quantifying the spill-over benefits of schooling or medical care. On the other hand, the problem of measuring spill-over benefits is less crucial for comparisons of rates of return between different levels. If we believe that all levels of education generate external benefits, it is not too misleading to concentrate on a comparison of the direct benefits associated with different types of education.

The aim of cost-benefit analysis is often to compare the returns to education with those to alternative investment opportunities in the economy, in order to answer the question "is education allocated sufficient resources?" If so, we need an estimate of the alternative rate of return or opportunity cost of capital, either for the economy as a whole, or for the private individual. In developing countries capital is scarce, so that the planner hopes to invest in projects with a relatively high rate of return; on other hand, experience shows that the actual rate of return on physical capital in manufacturing industry is often fairly low. Opinion varies about the appropriate rate with which to compare social rates of return to education. Some writers have used 12 per cent, others have assumed higher or lower alternative rates of return. It is slightly easier to make an evaluation of the private yield of educational investments. Estimates are usually available of the average post-tax yield of private investments such as equities or government bonds; in some circumstances, it may be more appropriate to look at average borrowing rates for individuals.

Once the problem of selecting an alternative rate of return is solved, the calculated social and private rates of return can be used to provide 'direction signals' for investment policy. If the measures of both costs and benefits are reliable, the rule is simple: increase investment in projects whose rate of return significantly exceeds the alternative rate of return. Cost-benefit analysis can, therefore, be used to 'rank' alternative allocations of resources in terms of relative profitability. If, as we have already seen, however, the accuracy of rate-of-return calculations is subject to

doubt or possible bias, it is more difficult to answer questions such as "is education, as a whole, over- or under-expanded?", but it is still possible to draw conclusions about the relative profitability of different forms of education.

In all cases, however, comparisons of rates of return do no more than provide *signals* for change. A high rate of return can be interpreted to mean 'invest more', but it does not indicate how much more. For rates of return are essentially marginal rates, reflecting the present balance between supply and demand. After an increase in investment, which may be expected to change this balance, it is necessary to recalculate rates of return in order to estimate the effect of changes in relative supply and demand.

So far we have discussed the problems of using cost-benefit analysis in order to derive conclusions about investment policy. An alternative way of interpreting rates of return, however, is as an explanation of past or current trends in demand for education. For example, if the private rate of return exceeds the social rate of return to education, because of a policy of subsidizing students, and if the private rate is higher than alternative private investment options, then one would expect to see buoyant demand for education. Such a situation does exist in many countries. Similarly, if the private rate of return to a particular type of education is low in one country, and high abroad, one would expect to see emigration of educated people.

These few pages have done no more than indicate theoretical possibilities for interpreting and using the results of cost-benefit analysis of education. The next sections will examine some actual examples of cost-benefit analysis and will draw some final conclusions about the practical significance of such studies.

10. Examples of cost-benefit analysis of education

The earliest examples of cost-benefit analysis of education, in the USA, were a result of the development of the theory of human capital formation, formulated in the early 1960s. Thus, the aim of rate-of-return studies by such economists as Gary Becker, Lee Hansen, Jacob Mincer, Theodore Schultz and others was to explore the feasibility of applying cost-benefit analysis to education, and to develop a theory of investment in human capital. Although the work had obvious practical implications its first objective was to develop a new tool of economic analysis. In particular, Becker's work showed how the concept of investment in human capital helped to explain certain patterns of behaviour and certain economic phenomena, such as the shape of age-earnings profiles, and showed also that different activities, such as formal schooling and on-the-job training, could be analysed by using the same tools of cost-benefit analysis.[16] Further research in the United States has concentrated on such issues as regional and racial differences in rates of return, the influence of

16. See the work of G. Becker cited in 'Suggestions for further reading' at the end of this booklet.

investment in education on the distribution of income, the application of cost-benefit analysis to the study of occupational choice, the private demand for education and comparisons of alternative methods of financing education. All these issues are relevant to developing, as well as developed countries.

There are a number of applications of cost-benefit analysis in developing countries, which attempt to measure the profitability of investment in education. For example, studies of the rate of return on investment in India have the aim of showing which levels of education are most profitable and also whether there is any evidence of over- or under-investment in education.[17] These studies relate only to urban India, so that it is dangerous to draw from them strong conclusions about the over-all profitability of education in India as a whole. However, the general conclusion from these studies is that despite unemployment of graduates and school leavers, in India, private rates of return to education are high, but social rates of return are considerably lower. The most profitable investment, in terms of cost-benefit analysis, is primary education, which has the highest rate of return.

These studies have practical significance of two kinds. The first relates to the problem of allocation of resources between levels of education. Cost-benefit analysis suggests that in terms of current employment patterns, primary education is more profitable than higher education. Yet Indian educational policy has resulted in a far more rapid growth of expenditure at the higher levels. This is in part a reflection of the hope that future employment patterns will be significantly different from today's. However, the fact that there are, at a very conservative estimate, over half a million unemployed graduates and matriculates shows how expensive this policy has been, in terms of the country's scarce educational resources. Although the highest rate of return is to primary schooling, cost-benefit analysis does not suggest that a sudden attempt to introduce universal primary education can be justified on economic grounds, for this would totally transform the

17. See the publications by Blaug, Layard and Woodhall, and Psacharopoulos and Woodhall cited in 'Suggestions for further reading', for further discussion of the Indian studies.

relationship between demand and supply and therefore have a marked effect on the future rate of return. But it does suggest a reversal of expansion priorities. Another practical implication of cost-benefit analysis of Indian education is that it can help to explain why Indian students continue to demand higher education, in the face of educated unemployment. The high private rates of return, which all exceed the corresponding social rates, provide a vital clue to this phenomenon and emphasize the importance of government policy on fees and scholarships in determining the level of private demand for education. If the Indian government wishes to limit expansion of higher education, one important policy variable is the level of fees and scholarships, which partly determine the magnitude of private costs, and thus the profitability of education as a private investment.

One of the Indian studies calculated alternative estimates of rates of return, to show how different assumptions about the influence of wastage, unemployment, and ability affected the social and private rate of return. This showed, for example, that the effect of including the costs of wastage, when measuring social costs of education, was considerable. This emphasizes yet again the importance of policies designed to reduce stagnation and drop-out in developing countries.

Since these studies were carried out for India, evidence has become available for many more developing countries, as well as further estimates for developed economies. On the basis of successive international comparisons of rate of return studies that cover more than 60 countries over a period of 30 years, Psacharopoulos[18] has identified the following general patterns:

- The highest rates of return in developing countries are to primary education, followed by secondary education, with higher education appearing less profitable than lower levels of schooling.
- In all countries and levels of schooling, private returns are higher than social rates of return, because education is heavily subsidized.

18. See Psacharopoulos *op.cit.*

- Most rates of return to investment in education in developing countries are well above the 10 per cent yardstick commonly used to indicate the opportunity cost of capital.
- Rates of return are higher in developing countries than in industrialized countries, because of the relative scarcity of human capital.
- Rates of return to women's education are slightly higher than the rates for men, reflecting the fact that education increases labour force participation by women, as well as increasing their earning power.
- Comparisons between general academic education and specialized vocational and technical courses in secondary schools suggest that the general education is the more profitable investment, since the cost of highly specialized vocational education at the secondary level is high, while the benefits, in terms of increased earnings, are questionable.

Psacharopoulos draws several conclusions from these results, and identifies "implications for the shaping of educational policy, especially in developing countries".

- Under-investment exists at all levels of education, especially in Africa.
- Primary schooling remains the number-one priority for investment, since the social rate of return to primary education exceeds the returns to secondary and higher education.
- Reducing public subsidies to higher education and reallocating them to primary education would bring benefits in terms of both efficiency and equity.

Many of these conclusions are reflected in recent publications by the World Bank on the financing of education in developing countries. The fact that private rates of return are consistently higher than social rates, and that the returns to primary education exceed the rate of return to secondary and higher education is used to justify a reduction in the level of public subsidies for higher education, through the introduction or increase of tuition fees, charges for food and accommodation and student loans. A

'package' of reforms, including increased cost recovery in higher education and reallocation of resources to lower levels, particularly primary education, has been recommended by the World Bank for several developing countries, particularly in Sub-Saharan Africa, and cost-benefit analysis and rate of return estimates have been quoted in support of the policy.[19]

Cost-benefit analysis can be used, therefore, to provide evidence which relates to problems of resource allocation between different levels of education, between education and other forms of investment, and to questions of how costs of education should be shared between governments and individual students or their families. There is another category of problem to which cost-benefit analysis has occasionally been applied, namely the evaluation of individual projects. In some cases, it may be dangerous to assume that a rate of return to a particular type of education, calculated from current earnings which reflect a labour market shortage, will provide an accurate estimate of the profitability of a large-scale expansion of that type of education. For example, an attempt to apply cost-benefit analysis to the evaluation of a technical education project in Chile is open to criticism because it ignores the fact that very large-scale expansion would transform demand-and-supply relations, and, therefore, totally change the pattern of earnings, so that current earnings differentials provide a poor measure of expected future benefits.[20] A small-scale study in Jordan, which examined the costs and the earnings differentials associated with two different forms of technical education, is interesting in showing a possible application of cost-benefit analysis to the problem of choosing between alternative types of education leading to similar qualifications.[21] In this case, the costs of one form of technical

19. See World Bank, *Financing education in developing countries: an exploration of policy options*, Washington DC. World Bank 1986 and World Bank, *Education in Sub-Saharan Africa: policies for adjustment, revitalization and expansion*, Washington DC. World Bank, 1988.

20. 'Evaluating the expansion of a vocational training programme: a Chilean experience', one of a series of case studies published by IIEP in 1970.

education greatly exceeded the costs of the other; yet an analysis of earnings showed that the labour market placed a similar value on the output of the two types of school, so that the low-cost alternative offered a very much higher rate of return.

Other examples of applications of cost-benefit analysis include assessments of alternative strategies, for example replacement or repair of existing school buildings, or alternative patterns of teacher training. In both cases it is important to identify, measure and compare both costs and benefits.

These brief references show that cost-benefit analysis of education is possible in developing countries. But what is its practical significance for the policy-maker ? The final section of this booklet attempts to evaluate cost-benefit analysis as a practical tool.

21. N.M. Al Bukhari, 'Issues in occupational education and training: a case study in Jordan', Stanford University doctoral thesis, 1964.

11. Conclusions: the practical usefulness of cost-benefit analysis in educational planning

Educational planners in developing countries are constantly faced with the problems of allocating resources to education and between different types of education, in order to maximize society's goals. Economic growth is only one of these goals, but it is one to which high priority is attached in the under-developed world, so that any technique which promises to show which pattern of resource allocation will yield the greatest returns is likely to be welcome. In recent years some exaggerated claims have been made for cost-benefit analysis, and critics have been quick to point out that this new economic technique does not automatically solve problems of allocation. The investment rule 'to invest in those projects offering the highest rate of return' appears simple enough, but when it is recognized that the calculation of the rate of return depends upon critical assumptions about the extent to which earnings reflect productivity, the extent to which earnings are influenced by tradition or by the distribution of ability and family characteristics in the population, the extent to which future demand-and-supply relations will match those observed today, and so on, it may appear that cost-benefit analysis has, after all, little to offer the educational planner.

Cost-benefit analysis does not offer an automatic solution to problems of resource allocation. It is often difficult to interpret social rates of return because of known distortions in the labour market, or because the future pattern of demand and supply is likely to be totally different from that prevailing today.

Cost-benefit analysis also does not provide numerical targets for the planner. At best, it provides a direction indicator: 'to invest in this type of education', not 'to provide places for x thousand secondary school pupils or engineering students'. Single-valued estimates of rates of return may be misleading whereas sensitivity-analysis can do no more than provide estimates of a range of values, within which the 'true' rate of return will fall. At first sight, then, cost-benefit analysis does not provide the answers for which educational administrators or planners seek.

On the other hand, cost-benefit analysis may point to questions which it is important to ask, and which have been ignored in the past. What evidence is provided by the pattern of earnings of educated manpower of a shortage or excess supply of certain manpower categories? What is the relationship between the costs of educating highly qualified manpower, and its utilization in the labour force ? What effect would a change in salary structures have on private demand for education ? What scope is there for the government to influence private demand for education by manipulating financial incentives, for instance, by changing student aid policies, introducing loans in place of grants or providing extra subsidies to overcome critical skill shortages? This is no more than the start of a list of questions that may be thrown up by cost-benefit analysis of education. And techniques that suggest fruitful questions may be as useful, in the long run, as answers to existing questions.

But does cost-benefit analysis provide any answers? It may be useful in decision-making in a number of ways. (a) Cost-benefit analysis may point to the need for changes in resource allocation, in favour of those types of education offering the highest rate of return. Since cost-benefit analysis is a form of marginal analysis, it can never show what will be the effect of a very large-scale change in the pattern of allocation, or specify the precise magnitude of the change, but it can provide 'direction indicators'; (b) cost-benefit analysis may suggest ways of increasing the profitability of education, either by increasing its benefits or lowering costs. Measures for improving the utilization of manpower will raise the benefits associated with education, while

measures to reduce wastage will lower costs; in either case, the rate of return to education will increase.

Finally, perhaps the most important aspect of cost-benefit analysis is that it provides a conceptual framework for the examination of the costs of education in relation to the relative earnings of educated manpower. Both these elements have been neglected in some educational planning exercises, based solely on forecasts of manpower requirements or social demand.

Some of the literature on educational planning has represented cost-benefit analysis and manpower forecasting as mutually exclusive approaches to planning. This is unfortunate, for both manpower forecasting and cost-benefit analysis are attempts to achieve the same goal: the rational allocation of resources in order to avoid shortages or surpluses of educated manpower, and to ensure the most efficient use of scarce resources in terms of economic growth. In fact, the two techniques can be complementary. Cost-benefit analysis provides a means of assessing the current demand and supply situation. Short-term manpower forecasts suggest ways in which the supply of educated manpower should be modified in order to achieve a new pattern of labour distribution. An analysis of the new pattern of earnings differentials then provides a means of assessing the responsiveness of the labour market to the new supply situation, and an analysis of costs shows the resource implications of the change in supply. A new cost-benefit calculation can then provide a means of relating this information about supply and demand in such a way as to suggest further modifications in supply.

Used in this way, cost-benefit analysis can supplement the information provided by manpower forecasts. At the same time, analysis of the labour market and manpower patterns can supplement cost-benefit analysis, for instance, by making it possible to calculate 'shadow' rates of return, which more nearly reflect true marginal productivities than those calculated from observed data.

In fact, it is the framework of cost-benefit analysis, with its emphasis on both the supply and the demand for educated manpower, and its emphasis on the costs of education as well as its supposed benefits, that is likely to be of most value to

educational planners in developing countries. Numerical calculations of rates of return may be helpful, but it is more important to attempt some sort of systematic comparison of the costs and benefits of a project, and the balance between them, than to make precise estimates of rates of return. It may prove difficult in certain situations to obtain data for precise calculations of rates of return. These are, in any case, subject to some difficulties of interpretation. On the other hand, if every proposed expansion of education were examined in the light of its real costs, and its likely effects on the relative wage structure in the economy, educational planners might well avoid some expensive mistakes'

Cost-benefit analysis is likely to be accepted more readily by educationists when progress is made towards the quantification of some of the indirect benefits of education. Even so, there will always remain objectives which cannot be measured in economic terms, and cost-effectiveness analysis may be a more appropriate technique for measuring the success of educational systems in satisfying such objectives.[22] In the case of both cost-benefit and cost-effectiveness analysis, the essential principle is that an attempt is made to judge both the results of a project and its costs.

In conclusion, we might return for a moment to the concepts of 'opportunity cost' and 'alternatives foregone' that were discussed earlier in the booklet. The virtue of cost-benefit analysis is that it focuses attention on the problem of choosing between alternative investment patterns, yielding different combinations of benefits in relation to costs. Educational plans, framed in terms of 'requirements' or 'needs', may obscure the obvious fact that all planning consists of choice between alternatives. If cost-benefit analysis does no more than serve as a reminder of this truth, it will have practical significance.

22. For a discussion of the differences between cost-benefit and cost-effectiveness analysis see G. Psacharopoulos and M. Woodhall, *Education for development: an analysis of investment choices*. Oxford University Press, 1985.

Suggestions for further reading

These items cover, in much more detail, some of the issues discussed in this booklet; several of them assume a knowledge of economics.

(1) The theory of cost-benefit analyis

G. BECKER, *Human capital, a theoretical and empirical analysis with special reference to education,* New York, Columbia University Press, 2nd edition 1975 (National bureau of economic research, no. 80).

M. *BLAUG,* 'The rate of return on investment in education in Great Britain', *Manchester school of economic and social studies,* Manchester, September 1965; reprinted in M. Blaug (ed.), *Economics of education--selected readings, vol. I,* Harmondsworth, Middlesex, Penguin Books, 1968, pp. 215-259 (Penguin modern economics).

T.W. SCHULTZ, 'The rate of return in allocating investment resources to education', *Journal of human resources,* Madison, Wisconsin, summer 1967.

B.A. WEISBROD, 'Education and investment in human capital', *Journal of political economy,* Chicago, University of Chicago Press, 1962 (supplement); reprinted in *Economics of education --selected readings, vol. I,* op. cit., pp. 156-182.

(2) Examples of cost-benefit analysis in developing countries

M. BLAUG, R. LAYARD, M. WOODHALL, *The causes of graduate unemployment in India,* London, Allen Lane The Penguin Press, 1969.

M. CARNOY, 'Rates of return to schooling in Latin America', *Journal of human resources,* Madison, Wisconsin, summer 1967, p. 359.

J. MINCER, *Schooling, experience and earnings,* New York, National Bureau of Economic Research, 1974.

A. MINGAT and J-P TAN, *Analytical tools for sector work in education,* Baltimore, Maryland, Johns Hopkins University Press (for the World Bank), 1988.

G. PSACHAROPOULOS, *Returns to education,* Amsterdam, Elsevier, 1973.

G. PSACHAROPOULOS, "Returns to education: an updated international comparison", *Comparative education,* Vol. 17, No. 3, 1981, pp. 321-41.

G. PSACHAROPOULOS and M. WOODHALL, *Education for development: an analysis of investment choices,* New York, Oxford University Press, 1985.

(3) Applications of cost-benefit analysis

WORLD BANK, *Financing education in developing countries: an exploration of policy options,* Washington DC. World Bank 1986.

WORLD BANK, *Education in Sub-Saharan Africa: policies for adjustment, revitalization and expansion,* Washington DC. World Bank, 1988.

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