SOME THEORETICAL CONSIDERATIONS IN APPLYING COST-BENEFIT ANALYSIS TO BLACK EDUCATION IN SOUTH AFRICA

Dissertation

Submitted in Partial Fulfilment of the

Requirements for the Degree of

MASTER OF COMMERCE

of Rhodes University

by

STEPHEN GERALD HOSKING

January 1983

CONTENTS

Page

Page

ACKNOWLEDGEMENTS

There are many people who have helped make this thesis a reality but five people in particular stand out for the guidance and or support they have provided me this connection. They are, Prof. Mihkel Truu and Dr. Philip Black, who together supervised my work, Mrs. L. Ranchhod, who typed my work, and my parents. I express my sincere thanks to all those who have helped me and in particular to those mentioned above.

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

In this thesis some of the economic theory underlying the application of cost-benefit analysis to education is considered with the view to discussing its relevance to the field of educational provision for Black people in South Africa. The fact that educational facilities available to Blacks are so vastly inferior to those of the Whites has given rise to virtual consensus that more has to be provided for the Black population. The economic implications of education are frequently cited to support this viewpoint. Using (a) the theoretical bases established in chapters 1 and 2, (b) the review of the rate of return to education studies in chapter 3 and (c) the broader socio-economic considerations introduced in chapter 4, it is concluded that this viewpoint is not necessarily well founded in South Africa and that the potential for greater use of the techniques described, is far from exhausted.

Each chapter contains an introductory section, in which some background to it is provided; the relevant references are listed at the end of each chapter. For the sake of convenience and economy of words, abbreviations are used fairly extensively, for example, CBA for Cost-Benefit Analysis, and where it is thought that the meaning of a concept may not be obvious, hyphens are often used between related words, for example, rate-of-return is connected in this way, when used as an attributive adjective.

In chapter 1 cost-benefit analysis theory is surveyed; a fairly comprehensive coverage of the methodology is followed by some comments relating to problems which arise in the use of the technique. Chapter 2 deals with the human-capital background to the use of cost-benefit analysis in education, ending on the note that considerable controversy still characterized discussion in this field of research. In chapter 3 some research related to the applications of cost-benefit analysis to Black education in South Africa is reviewed against the background of some international studies done in the field of returns to education. Finally, in chapter 4 an attempt is made to

integrate the theoretical considerations which seem applicable to the planning of Black education in South Africa into a single framework. Unfortunately however, the state of knowledge and available data at the present time, do not seem to permit any obvious policy prescriptions. This does not, of course, mean that economic analysis is not without application in the field of educational planning, including the case of Black people in South Africa, but rather that the existing techniques tend to be used in an arbitrary manner, if at all.

Perhaps the most notable theoretical consideration related to rate-of-return analyses, but which is not discussed in any detail in this thesis, is the relationship between educational provision and economic growth. Included in this area of discussion is not only the measurement of the contribution of education by means of suitably specified production functions, but also theories relating economic growth to education on a basis of such measures such as literacy rates, primary school or secondary school enrolments, etc. Another area which is not considered at length here, although due to its current popularity some mention is made of it, is the statistical estimation of earnings functions for the purpose of calculating rates of return to education. Finally, no pretention is made at dealing with the complete range of significant impacts of education, and consequently the thesis contains very little discussion of the non-economic impacts of education and their analytical implications.

CHAPTER 1

AN OVERVIEW OF COST-BENEFIT ANALYSIS

In this chapter, the origins of cost-benefit analysis are briefly discussed, the methodology of cost-benefit analysis is surveyed and finally, a brief evaluation is attempted.

(I) ORIGINS AND INTRODUCTION

Cost-benefit analysis (C.B.A.) is an economic technique used in project appraisal which seeks to encompass in its arithmetic all costs and benefits associated with an envisaged act of investment. It has the potential therefore, to serve as a very useful guide in decision making on the canalisation of public investments. Attention to this approach dates back to the Nineteenth century according to Prest and Turvey.[1] In a comprehensive survey of C.B.A. they suggest that Dupuit's[2] paper on public utility works in France, published in 1844, was pioneering in this field. However, the widespread application of C.B.A. did not occur until the Twentieth century and in its initial stages this was almost entirely in the U.S.A. In the United States it was introduced by the 1902 River and Harbour Act which required the accounting for of costs and benefits to commerce of the various river and harbour projects. Subsequent to this the 1936 Flood Control Act consolidated the momentum built up in the application of the technique and from here it spread rapidly to other applications and countries.

In the field of education C.B.A. took rather longer to make an impact and its widespread application appears only to have gained popularity with the tremendous surge of interest in the field of the investment in human capital in the late 1950's and early 1960's. A pioneering figure in stimulating interest in this application was Theodore Schultz.[3] Since then there have been a large number of studies on the returns to education

in many different countries. A landmark in this particular application of C.B.A. is provided in the mid-1970's by Psacharopoulous[4] who attempted to synthetise the results of many such studies. He found, inter alia, that internationally there was a positive and substantial rate of return to education, that primary education yielded the highest rate of return and that differences between various rates of return lent themselves to explaining facets of the development process.

Parallel with the growth in use of C.B.A. has been growth in criticism of the technique and it is against this background that the more cautious modern approaches to the use of C.B.A. are best understood. Initially the focal point of the criticism was theoretical; positive economics was set to being replaced by normative economics. It was realised that embodied in the technique was the need for subjective judgemental assessments. Following this the centre of criticism switched to the empirical aspects of C.B.A. and a key issue to emerge was the identification problem. In the field of education this problem is particularly severe as one expects earnings differences to be associated with both education and individual ability (amongst other things).

Although there is no unanimity in the position taken up in response to these criticisms it appears that a more cautious approach to the use of C.B.A. dominates. Not all costs and benefits are aggregated - some are left out of the arithmetic and presented as statements of consequence,which are left for the decision maker to weigh up along with the 'partial' C.B.A. results. Another standpoint commonly adopted is to abandon the attempt to value the more contentious outputs of public investments and only aggregate the 'hard' data on costs. The idea, then, is to determine various output indices which are compared over time with the aggregated cost data. This approach is described as cost-effectiveness analysis (C.E.A.). While many authors[5] see a place for C.E.A. in the field of micro-economic guidance to education planners, it offers much less as a guide to investment in the field of education than does C.B.A.

Almost all authors would acknowledge that C.B.A. does not yield a 'precise' result but that it does suggest something useful about the relative attributes of possible investments (and as such constitutes a valuable tool to the decision maker).

(II) METHODOLOGY

In this section the discussion will be orientated toward the following main considerations - the costs and benefits to be included in the analysis, the valuation of these costs and benefits, the constraints to be included in the analysis and finally the rate of interest at which the costs and benefits are to be discounted. It should be observed that the individual sections are closely interrelated and it is more for convenience than because of the segmented nature of the topic that they are discussed separately. The discussion is at a general level and relates not only to education, but to a broad range of public projects. The human capital theory relevant to the application of CBA to education is largely left to chapter 2 although references to it are also contained in this outline of the methodologgy of C B A.

(i) COSTS AND BENEFITS INCLUDED IN CBA

Quite simply, all relevant costs and benefits must be included in the analysis. However, in doing this, two problems frequently occur. Firstly, there is the problem of categorizing the various costs and benefits. The main problems in this regard arise out of the variety of terms used to distinguish different effects, the overlapping of meanings of these terms and whether to include 'non-economic' or psychic effects in the analysis. The argument that everything boils down to economics in the end will often lead to insuperable valuation problems. Secondly, there is the problem of 'double counting', i.e. the erroneous counting of a benefit or cost more than once.

The most common distinction between types of costs and benefits is that made between private and social effects, and the

differences between these effects are normally attriubted to externalities (alternatively termed spillovers), market imperfections and government intervention. Pigou[6] in his celebrated discussion on the definition of marginal private and social net products provides the basis for a distinction between private and social effects. The private effects are those, "which accrues in the first instance - i.e. prior to sale - to the person responsible for investing resources there"[7], while the social effects relate to everyting which affect the "national dividend"[8], which describes the material welfare of a people. Excluded from consideration are the costs and benefits accruing to people in other countries and any psychic effects.

The way that government intervention may lead to divergence between private and social effects is through the imposition of taxes, subsidies, exchange controls and direct regulation. State intervention cannot be relied upon to equalize the private and social effects because it is often motivated by reasons such as revenue raising or balance of payments deficits or redistributional considerations, which may work against this equalization. As a result although private effects completely encompass State intervention in their calculation, social effects usually do not. Besides State intervention, market imperfections and externalities (the latter two being discussed later),differences between the private and social effects can also be attributed to the timing of costs incurred as social costs are incurred as soon as resources are moved but private costs may occur well after this.

Both private and social effects may be said to have technological and pecuniary externality components.[9] Technological effects are those which change the physical production possibilities of other producers or which change the satisfaction consumers are able to derive from given resources, eg. pollution of water and the realization of economies of scale. Pecuniary effects are those brought about through an alteration in the demand conditions facing other markets. However, for practical purposes the

distinction between the technological and pecuniary externality effects is not very useful. The example of economies of scale which are realised in other industries illustrates the point. While this is a technological externality, it is brought about through a change in demand and therefore, is also pecuniary externality. Furthermore, there is a danger that with the inclusion of pecuniary effects in the analysis, that redistributional effects could be mistakenly be counted as externality effects. By way of example, it is incorrect to count extra cafe´earnings in a certain locality as a result of a newly built highway when the extra trade that these cafés are getting is merely trade diverted from other cafés on the old road.

Also very relevant to the question of what costs and benefits should be included in the analysis, is the problem of double counting. The problem arises in the accounting for of indirect effects of a project and is perhaps best illustrated by example. Take an irrigation project for the purpose of growing wheat as the example.[10] In the example let the markets be characterised by perfect competition and the retail cycle be from farmer to miller (wheat), miller to baker (flour) and baker to consumers (bread, a normal good). Furthermore, let the result of the irrigation project be that the cost of producing wheat declines and the supply curve of wheat shifts to the right, causing corresponding shifts of the supply curves in the flour and bread markets. This yields three 'apparent' changes in consumer surpluses - one in the wheat market, one in the flour market and one in the bread market. Although it is tempting to add all three of these to derive a composite change in consumer surplus, this would be wrong - it would be double counting.
There is only one consumer suplus and that is in the consumer's market, i.e. the bread market. Note however, that the consumer suplus is nevertheless reflected in the flour and wheat markets if there is efficient operation by the pricing mechanism. Thus,

in the example given above, the consumer surplus could be reflected in any one of the wheat, flour or bread markets. However, where some of the wheat was channelled into other uses, eg. cattle feed, then only one market will reflect the full consumer surplus arising from the irrigation project and that would be the wheat market.

(ii) VALUATION OF COSTS AND BENEFITS

There are often great deviations from what is in principle most desirable and what is feasible or done in practice - the valuation of cost and benefit effects is no exception and the problem is compounded by the addition of considerable divergence of opinion on the principles themselves. The terms "approximate" or "guesstimate" become more descriptive of the valuation process than terms suggesting precision or fine accuracy. However, this does not serve as a basis for rejecting the technique altogether, it is a qualification of the technique, requiring that the decision maker interprets the analysis as an indication of the relative worth as against the precise worth of a project's effects.

The problem of valuing costs and benefits involves three main considerations - valuation when prices change and the concept of consumer surplus (and producer surplus), the use of shadow pricing and finally, externalities and public goods.

(ii.1) VALUATION WHEN PRICES CHANGE AND THE CONCEPT OF CONSUMER SURPLUS (AND PRODUCER SURPLUS)

One of the great difficulties in CBA lies in the valuation of project outputs. If prices do not change as a result of the additional output yielded by a project, the value of this output could be based on the prevailing market price. Two reasons why prices may not change are,

(a) that the project output so marginally increases the total amount of the good available to the market that it causes an ignorable alteration in market conditions, or

(b) that the market demand curve is so elastic over the relevant output range, that it gives rise to a situation where prices are not altered by a change in total output available.

However, where (a) or (b) were not expected to hold, then price and output changes initiated by the project cannot be ignored. Such a situation is depicted in figure 1.1 below. In this situation two problem areas arise, namely, what price should be used to value the increased output and what constitutes the consumer surplus arising from the alteration in market conditions. Use of the term 'full conventional consumer surplus' below, relates to the Marshallian concept of consumer surplus, i.e. the difference between the amount that the consumers would have been willing to pay the retailer, had he been able to practice perfect price discrimination, and the amount which they do pay. In this section these problems are examined against cardinal and ordinal utility backgrounds - the conclusion being that neither yields positive results. Finally, it is demonstrated that the concept of 'producer surplus' is not a very useful one.

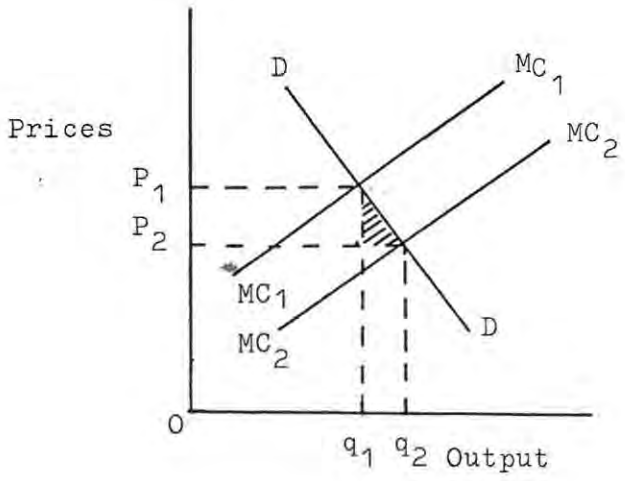


Figure 1.1

In Figure 1.1 let the effect of undertaking a particular project be the shifting of the supply curve to the right from MC_1 to MC_2. This causes prices to fall from P_1 to P_2 and output to rise from q_1 to q_2. (For simplicity in the equations below P_1, P_2, q_1 and q_2 are used instead of OP_1, OP_2, Oq_1 and Oq_2.) This additional output is valued at what the consumers actually pay of it, i.e. $P_2\ (q_2-q_1)$ plus that part of the conventional consumers surplus related to the additional output, i.e. $\frac{1}{2}(P_1-P_2)(q_2-q_1)$, (the shaded area) where the linearity of the demand curve is assumed over the range q_1 to q_2. The full conventional consumer surplus is represented by the area $(P_1-P_2)q_1 + \frac{1}{2}(P_1-P_2)(q_2-q_1)$. However, while all of this area describes what is termed consumer surplus, the measure which is taken to represent the benefit accruing from a project normally is restricted to the area under the demand curve for the additional output only. Hence, $P_2(q_2-q_1) + \frac{1}{2}(P_1-P_2)(q_2-q_1) = \frac{1}{2}(q_2-q_1)(P_1+P_2)$, is normally taken to represent the value of the total incremental product arising out of the undertaking a particular project.

Consumers surplus, as it was first formulated in terms of cardinal utility, was the money measure of the utility yielded by the change in consumption,[11] i.e. $\frac{\partial U}{\partial Q} = \frac{\partial U}{\partial Y}.P$ over the full range of output, where $\frac{\partial U}{\partial Q}$ is the utility yielded by a change in consumption and $\frac{\partial U}{\partial Y}.P$ is the marginal utility of income times the price, i.e. the money measure of $\frac{\partial U}{\partial Q}$. However, there is an unsatisfactory element in this measure of consumer surplus, namely the unpredictability of $\frac{\partial U}{\partial Y}$. As P falls, the purchasing power of money rises, causing $\frac{\partial U}{\partial Y}$ to rise, but simultaneously, as P falls so real income rises causing $\frac{\partial U}{\partial Y}$ to fall (by the hypothesis of diminishing marginal utility of income). Thus the money measuring rod of consumer surplus may vary as we move along the conventional demand curve and to

assume a constant relationship between changes in price and changes in utility yielded by changes in consumption, as is assumed for conventional consumer surplus, may be erroneous. One way to "overcome" this is to use a Hicksian[12] framework where different measures for consumer surpluses are obtained, and most importantly, where variations in utility are not a problem.

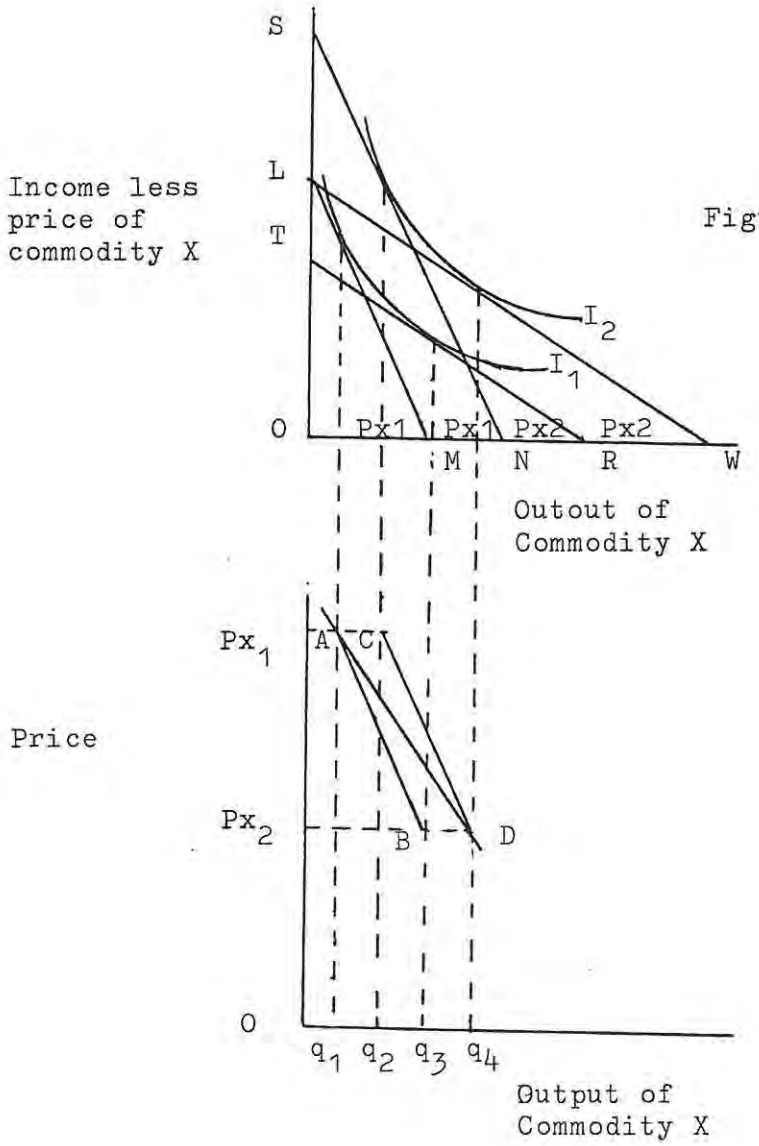


Figure 1.2.a

Figure 1.2.b

In Figure 1.2.a, I_1 and I_2 are indifference curves and SN, LW, LM and TR are budget lines, and in Figure 1.2.b; AB, AD and CD are compensated, uncompensated (conventional) and equivalent demand curves respectively, which are derived from Figure 1.2.a. Suppose initially that the price of commodity X is Px_1 (and the persons indifference level I_1), but that after the project it is reduced to Px_2. This causes a shift in the budget line from LM to LW and we see from the indifference map that this results in the consumer increasing demand of commodity X from Oq_1 to Oq_4. From this we may determine points A and D in figure 1.2.b on the demand curve for commodity X and, by assuming linearity, it immediately follows that AD forms the conventional demand curve. The corresponding consumer surplus is Px_1 $ADPx_2$.

As we proceed down this demand curve AD the consumers utility is rising as is reflected by the budget line LW intersecting a higher indifference curve, I_2. The cause of this, is the income effect LT of a fall in the price of commodity X. We may remove this effect by "taxing" the consumer LT, which is reflected geometrically by drawing a line parallel to the after-price-change budget line LW, and tangentical to the consumers original indifference level, I_1. The amount of commodity X demanded by the after-taxed consumer is Oq_3. The difference Oq_3-Oq_1, reflects the pure substitution effect resulting from a fall in price of commodity X from Px_1 to Px_2, and the resultant demand curve which corresponds to this, in figure 1.2.b, is AB and is defined as the compensated demand curve. The 'compensated variation' (consumer surplus) is Px_1ABPx_2 for this demand curve.

By asking, when the price of the good was Px_2, what income the consumer would have been prepared to forego in order to avoid a price rise to Px_1, yet another demand curve may be derived, the 'equivalent' demand curve. By

reasoning that the consumer is prepared to forego SL income to avoid a price rise (i.e. to stay on the same level of indifference) we find that his demand curve is defined by CD and it follows that the equivalent variation (consumer surplus) is Px_1CDPx_2. For a normal good, CD will be to the right of AB, but for an inferior good CD will be to the left of AB. Only where there is no income effect will all three curves AB, AD and DC be identical.

The reason for introducing the different demand curves above was to obtain a "better" measure of consumer surplus. Two further measures of consumer surplus were derived - we now tackle the question of whether these enable us to make improved decisions on the worth of projects. For this purpose we examine what is termed the "compensation test"[13] for determining the worth of a project. The compensation variation LT is the maximum those consumers benefiting from a price fall can afford to pay the losers in order to be as well off as they were at the original price (Px_1 in this case). Alternatively, the equivalent variation LS is the minimum compensation required by the losers from a price rise to be as well off as they were before the change in price. By letting consumption variation represent the gains resulting from a project and equivalent variation the losses resulting from a project we may derive the following condition for project acceptance:

$$\sum_{i=1}^{m} CV_i > \sum_{j=1}^{n} EV_j$$

, where CV_i = compensation variations of individual i=1...m and EV_j equivalent variation of individual consumers j=1....n.

However, $\sum CV > \sum EV$, although a necessary condition for Pareto development, can be shown not to be sufficient.

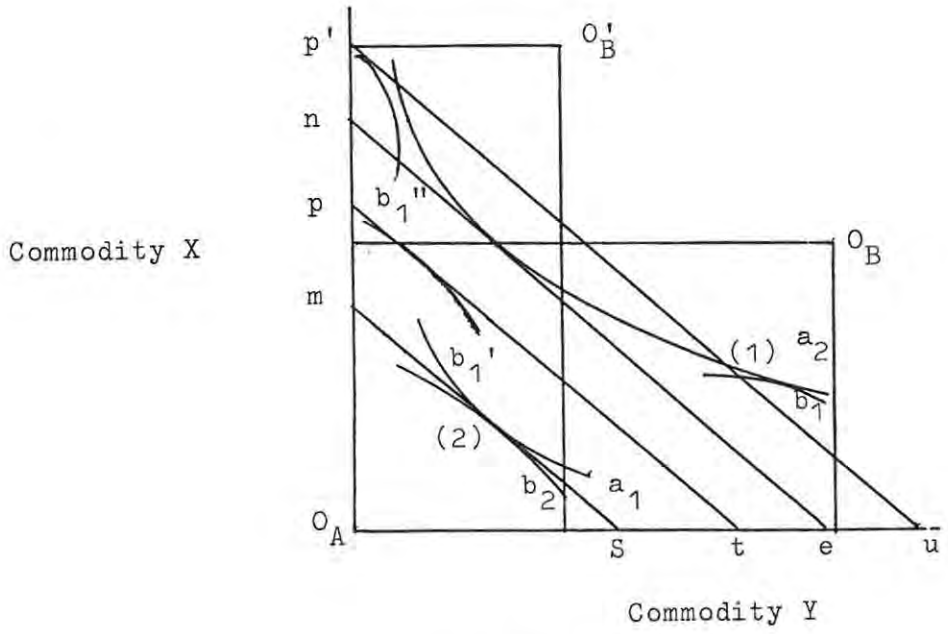


Figure 1.3

In the Edgeworth box above (figure 1.3); a_1, a_2, b_1, b'_1 and b_1'' are individual indifference curves and ms, pt, ne and p'u are budget lines. The first combination of goods (1) corresponds to origins O_A and O_B for consumers A and B respectively, and the second combination of goods (2) corresponds to origins O_A and O'_B, again for consumers A and B respectively. The shift, brought about by a project, (considered in order to explore the sufficiency of the compensation test) is from position (1) to position (2). The compensation required by consumer A to remain at indifference level a_2 is mn. Whether B can afford to compensate mn will depend on his indifference curve's (b_1) position - this we consider with respect to the origin O_B'. If it lies at position b'_1, for example, then it fails the compensation test because mn $>$ mp, where mp is the gain to consumer B and mn is the loss to consumer A, and thus $\sum CV < \sum EV$. Similarly no Pareto

improvement in welfare could be argued. However, if B's indifference curve lies at position b", with respect to origin O_B' then B would be prepared to compensate A up to mp' which is greater mn and implies $\Sigma CV > \Sigma EV$. But, this does not lead to a Pareto improvement because b_1'' and a_2 do not intersect, thus no new bundle of goods could be found in which both consumers were at least as well off as they were at position (1) and thus we may conclude $\Sigma CV > \Sigma EV$ is not a sufficient condition for Pareto improvement in welfare.

It would appear therefore, that the application of the compensation test ($\Sigma CV > \Sigma EV$) is not conclusive. Bearing this in mind, and also the recognition that whichever measure is chosen in practice, it is unlikely to make much difference to the final outcome,[14] one could conclude for the sake of simplicity if nothing else, that the area under the conventional demand curve, (as originally described), still merits selection for the purpose of determining consumer surplus.

Another question which can be asked, is whether the concept of a producers' surplus should be included in the analysis.[15]

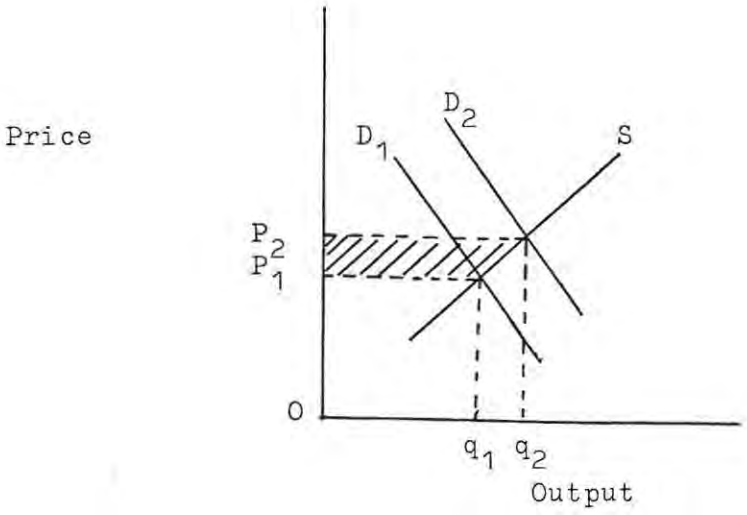


Figure 1.4

In Figure 1.4 demand expands exogenously from D_1 to D_2. In a pure exchange economy (i.e. no production) the supply curve would represent the minimum price at which the supplier would be willing to part with each unit of the good. Thus when the price rises from P_1 to P_2 the supplier receives additional payment over and above that which he is prepared to supply the intra-marginal goods i.e., the shaded area. However, if we now let S represent the long run supply curve, which in the case of figure 1.4 implies an increasing cost industry, then the rise in price merely reflects the rise in average costs, and the suppliers (producers) are not benefited by any additional profits. If the cause of the rising trend in the long run average cost curve of the producers was due to an increase in rent accruing to the owners of certain factors of production then perhaps effects such as 'workers' surplus and 'capitalists' surplus could be associated with the area in question. But as this is not necessarily the case, (the rising long run average costs could be associated with diseconomies of scale where no surplus accrues to anyone), what is meant by producer 'surplus', is perhaps best left out of the cost-benefit calculus.

(ii.2) THE USE OF SHADOW PRICING

A major valuation problem to which analysts using the cost-benefit apparatus have devoted considerable attention, relates to the inefficiency of market prices as indicators of the social value of particular commodities and the social cost of factor inputs. These inefficiencies arise out of distortions in the economy such as excessively high tariff barriers, politically inflated wages, monopoly profits, administered prices of basic goods and foreign exchange constraints. From the point of view of the economy as a whole, the reliability of rates of return measures to investment, depends on the market prices

accurately reflecting social costs and benefits. Distortions imply that market prices do not accurately reflect social costs and benefits and thus adjustments to market prices are desirable for project appraisal. These adjusted prices are variously called shadow prices, social prices or accounting prices. In this section the pricing of commodities is considered first and the costing of the two relevant factor input classes, land and labour, are considered after that.

Despite the existence of distortions in the domestic economy it could be argued that market prices should still be used for valuation purposes. There could be other forces at work such as the fear of competition or government intervention which lead monopolistic firms to set prices which would approximate those which would prevail under perfect competition. Furthermore, tariffs, taxes and subsidies could be set as a deliberate attempt by the government to correct for market imperfections. But while these situations may be true for particular cases, they clearly are not generally valid - given that the profit motive predominants in the private sector, monopolies will be inclined toward abnormal profit situations, and tariff and taxes are often set for quite different reasons than to correct for market imperfections. For example, they could have been set alternatively as an historical accident or to raise revenue or to redistribute income.[16] It would appear therefore, that domestic commodity prices, taken as they are, may not be desirable for CBA purposes.

One possible solution to domestic distortions is to look outside of the domestic economy for a guideline on prices, i.e. at international prices. International prices offer a real opportunity price alternative to domestic prices, but clearly before one may argue that they are directly applicable, the goods should be imported or exported by the domestic economy. This does not mean however, that

goods not traded in this way should be left out of the analysis, they could still be valued in terms of the same unit of account (numéraire). Little and Mirrlees[17] are the leading proponents of this approach. "In any price system what matters is relative prices, for these relatives measure the rates at which real goods and services can be exchanged for each other. If one can find, in an otherwise chaotic system, some price relatives which reflect real opportunities open to the economy, then these can be used as sheet anchors. In our system the border prices of traded goods fill this need."[18]

Little and Mirrlees divide commodities into two categories - traded (and tradeable) and non-traded goods. Traded goods are valued at f.o.b. (free on board) or c.i.f. (cost insurance freight) prices which are taken to represent their marginal export revenue or marginal input cost respectively. For any good, where f.o.b. and c.i.f. prices are determinable, even in a partial sense, the good is regarded as tradeable. But where f.o.b. and c.i.f. prices are definitely not determinable, the good is regarded as non-tradeable. In this case the social cost of production is still valued in the numéraire of tradeable goods, namely, its foreign exchange opportunity cost - the determination of which is achieved by the application of various "conversion factors"[19] to domestic prices. A "conversion factor" is an approximated constant relating border prices to domestic prices over a broad category of commodities.

Implicit in the Little and Mirrlees analysis is that the exchange rate varies in response to imbalances between exports and imports so that f.o.b. and c.i.f. prices represent real opportunities open to the economy and not artificial ones. One objection to this is that governments may not always accept exchange rate adjustments that would ensure balance of payments equilibrium. However, this objection may not be too serious if it is possible to

calculate shadow exchange rates for valuation purposes. One way to approximate a shadow exchange rate would be to determine what relative improvement in exports (imports)would be necessary to eliminate a trade deficit (surplus).[20] Using the definitions below,

X = exports, ΔX = change in exports,
M = imports, ΔM = change in imports,
esx = price elasticity of the supply of exports,
edm = price elasticity of the demand for imports,
rc = current exchange rate,
rs = shadow exchange rate,

we would require $M - X = \Delta X - \Delta M$ for a balanced trade account.

Now, $\Delta X = \frac{rs - rc}{rc} \cdot esx.X$, i.e. $\Delta X = \%\Delta P . \frac{\%\Delta X}{\%\Delta P} . X$

where $\frac{rs - rc}{rc}$ is the percentage change in domestic price received by suppliers for exports or alternatively paid for by importers for imports.

Similarily, $\Delta M = \frac{rs - rc}{rc} \cdot edm . M$ and thus,

$M - X = \frac{rs - rc}{rc}$ esx X - $\frac{rs - rc}{rc}$ edm M, which implies,

$$\frac{rs}{rc} = \frac{(1 - edm)M + (1 - esx)X}{esx\ X - edm\ M} \text{ , or,}$$

$$rs = \frac{(1 - edm)M + (1 - esx)X}{esx\ X - edm\ M}\ rc$$

= (conversion factor) multiplied by (rc).

Clearly, the Little and Mirrlees approach has much to recommend it - foreign exchange is a 'numéraire' which has an opportunity cost meaning over a broad spectrum of economic activities and which provides scope for considerable flexibility in overcoming distortions arising out of international trading activities.

We now turn to the other main category of costs, that of the factors of production, land and labour. Capital inputs are left for the discussion relating to discount rates, but it is worth noting for valuation purposes, that physical capital inputs are not distinguished from other physical commodities - the same border pricing technique is applicable. The difference arises because material capital inputs usually have their cost spread over a number of years whereas other material inputs are most often expended immediately. The shadow valuation of land presents some unique problems - the question of depreciation or appreciation cannot be dealt with by simple formula, speculative booms cause considerable variance the property values which are not always part of a long-run trend and different uses of land impose vastly different externalities on neighbouring areas. Nevertheless some discretionary estimate of the social opportunity cost of that land is necessary as the historical price paid by a public authority will often bear no resemblance to its opportunity cost.

Perhaps the factor market in which the divergence between market prices and opportunity costs is most apparent is in that of unskilled labour. The co-existance of structual unemployment with artificially high wage levels, (often politically or socially inspired), is particularly common in developing countries. Using the Little and Mirrlees[21] approach, described above, with respect to commodities, the shadow price of labour suggested, is the marginal product of labour at border prices. The problem with this, as Fitz-Gerald[22] points out, is that it yields a low estimate of the shadow price of labour, (usually described as the shadow wage rate,[23] (SWR)), because it neglects other costs inherent in the provision of employment. A more elaborate estimate of the SWR would allow for the costs of moving from rural locations to a project site, the increased overheads at a project site, the variance of rural employment due to the seasonal nature of argricultural

production and the effect of the migration of surplus labour from rural areas on the marginal productivity of urban labour.[24] Little and Mirrlees were not unaware of this and in fact incorporate these costs in their SWR formula. In addition they point out that employing more labour often implies a commitment to extra consumption by that labour over and above their marginal product, and consequently to less saving which may involve a social cost to the economy if it is very short of saving. It may be that socially, consumption is not equally as valuable as the social value of savings. If we accept this argument, it seems reasonable, then, that consumption as expressed in terms of the numéraire , namely, "uncommitted social income, measured in terms of convertable foreign exchange",[25] should accordingly, be weighted lower. By letting this weight be 1/S, where $S \geq 1$, it follows that the social cost of extra consumption generated by employment is $(1 - 1/S)(C - M)$, where C = consumption of a wage earner, M = marginal product of labour and $(C - M)$ is the incremental consumption arising out of the employment of labour. Thus Little and Mirrlees derive the SWR described below:

$$SWR = M + (C' - C) + (1 - 1/S)(C - M)$$

, where C' = C + costs of transport from rural locations and increased urban overheads; which simplifies to

$$SWR = C' - (1/S)(C - M)$$

In practice Little and Mirrlees recommend that the estimation of a standard "wage conversion factor"[26] be made and applied to the market wage rate across all categories of unskilled labour, i.e.

$$SWR = k. \text{ (market wage rate)}$$

, where k is the wage conversion factor.

In most CBA studies it is argued[27] that skilled labour comprises so small a portion of total costs that it is foolish to go to too much trouble over this item, but

clearly this is not valid in project associated with the provision of schooling where highly educated people constitute a substantial proportion of the employees. As these inputs are important in education provision, for this case, to follow the Little and Mirrlees approach outlined above, would involve the valuation of resources used in producing skilled labour by various conversion factors and assigning weights to these respective values - the final sum being the marginal social cost of producing skilled people. However, Little and Mirrlees argue that given a shortage of skilled people in developing countries, the use of a marginal social benefit concept rather than a marginal social cost one would be more appropriate for valuation purposes. This would appear to be best reflected simply by what employers are prepared to pay for the relevant skills, although serious objections to this, in principle, are suggested by the 'credentialist' approach discussed in Chapter 2. Yet another fruitful perspective one the valuation of skilled labour is provided by treating it as a tradeable good. The cost of a skilled labourer would then be the equivalent cost of an imported man, i.e. his remittances of currency out of the country plus his social cost of consumption within the country. On the same tack, but much simpler for the practical estimation of the shadow price of skilled labour, would be the use of the concept of the soical cost of retaining a potential immigrant for valuation , i.e. his full salary.

(ii.3) EXTERNALITIES AND PUBLIC GOODS

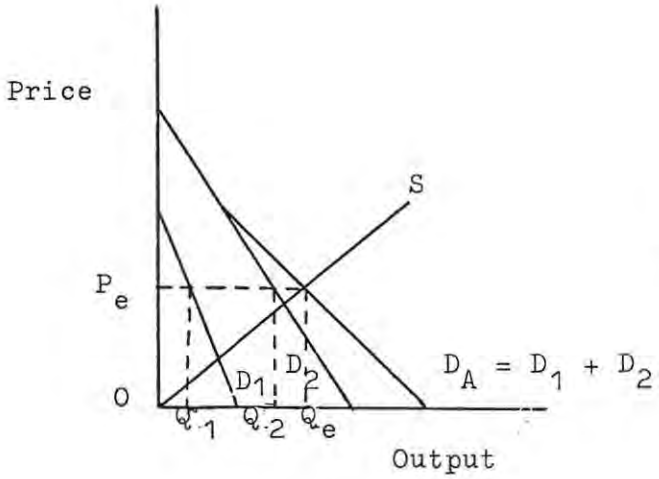
An externality exists where "a variable controlled by one economic agent enters the utility function of another economic agent"[28] and this influence is unpriced to the controlling economic agent. There are two types of economic agents between which such an interdependence could exist - producers and consumers. The interdependence described above could be between producers themselves

or between consumers themselves or between consumers and producers, but normally analysis focuses on the producer's effect on the consumer.

Externalities can be defined in different ways, but for the purpose of linking them with public goods only one division is considered here - excludable and non-excludable externalities. Excludable externalities are of the type which can be priced and thus regulated through the market mechanism. Non-excludable externalities are not pricable because there is no incentive for consumers or producers to reveal their preferences. No one could prevent the consumer or producer from benefiting from such a commodity and he would be induced to act as a so-called 'free-rider'[29] (see below for discussion) - such commodities are called public goods (i.e. a non-excludable externality is equivalent to a public good.)[30] Of course, many goods are neither pure public goods in the sense of their absolute non-excludability, nor pure private goods in the sense of their complete excludability in consumption and complete competitiveness in production. Blaug describes such goods as having varying "degrees of publicness."[31]

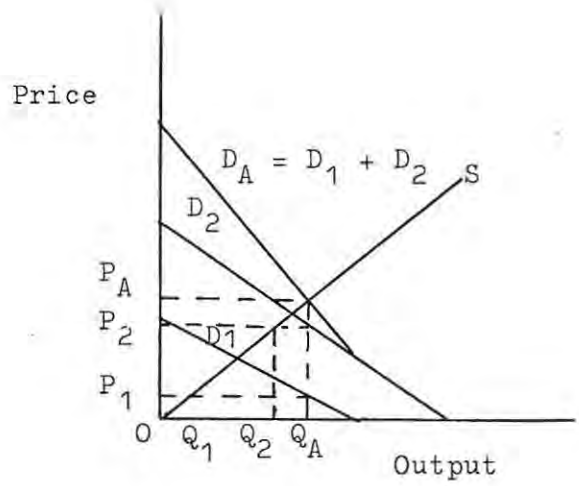
Before discussing the valuation of externalities it is important to understand the differences in aggregation between private and public goods. For a private good, by virtue of its excludability in consumption, the demand curves are horizontally summed and the equilibrium price is determined from where this horizontally aggregated demand curve intersects with the market marginal cost curve (i.e. P_e in figure 1.5.a). From this price the output demanded by the various economic agents comprising the aggregate demand curve, are easily determined (i.e. OQ_1 and OQ_2 in figure 1.5.a). For a public good each individual consumes the same amount of the good by virtue of the fact that such goods are characterised by non-excludability in consumption. Thus, the aggregate demand curve for a

public good is derived from a vertical summation of the individual demand curves, as shown below in figure 1.5.b.



(Aggregate demand for a private good)

Figure 1.5.a



(Aggregate demand for a public good)

Figure 1.5.b

In figure 1.5.a the average revenue curve for the market is $D_A = D_1 + D_2$ (the sum of individual quantities demanded) and in perfect competition where this intersects with the

marginal cost (supply) curve, determines the equilibrium price OP_e, which pertains to both consumers.

In figure 1.5.b the aggregate demand curve for the pure public good is $D_A = D_1 + D_2$ which is the vertical sum of individual demand curves. The intersection of DA and the marginal cost curve S, indicates the optimum amount of the public good which should be produced, namely OQ_A at price OP_A. The contribution of each individual to the cost OP_A, of providing this public good should be split OP_1 and OP_2 (which when added equal OP_A) between individuals 1 and 2. This cost is the same as that which they would have had to pay for less of the public good had either individual been the sole consumer of this good. It would nevertheless pay individual 1 or individual 2 to hide his or her preference for the public good, as they would still enjoy the benefit of the good by virtue of its non-excludability but would pay nothing for it. This is the 'free rider' problem which was referred to earlier. Its effect is to make the pricing of public goods very difficult.

A common approach to the problem of valuating externalities is to look for market situations where a price is implicitly suggested. One such technique uses property prices as an indicator of externalities, where positive externalities are taken as increasing the value of the property and conversely, negative externalities are taken as decreasing the value of the property. There seem to be considerable differences among economists[32] on the merits of this approach to the valuation of externalities. On theoretical grounds, it is questionable whether the individual's behaviour in the choice of property is constrained by nothing other than his income and an objective set to the property's attributes and even if this was accepted, it is doubtful whether a complete objective set of quantifiable attributes are practically determinable from different individuals in the community.

The question of the significance of externalities is very relevant to the field of education where for CBA purposes one wishes some idea of their presence so that recognition of these aspects may be given along with the calculations (or possibly even incorporated in them). It is often asserted[33] that education gives rise to various non-excludable externalities such as promoting more responsible political and social behaviour. For analytical purposes one could treat these effects in the same way as what may be termed the excludable externalities in education, i.e. the consumption benefits of education. If another market could be found where these values were implicitly included in the price then arguably this could offer a solution to the problem of valuating these effects. However, the problems involved in isolating these effects would be enormous, eg. how is politically responsible behaviour to be valued? It comes as no surprise then, that most authors[34] seem to favour either, the delination of an arbitrary sum to represent the externality effects, or that they be left out of the arithmetic of CBA altogether and specified separately as factors which should also be weighed in the decision making matrix (see chapter 4).

(iii) CONSTRAINTS WHICH MAY BE INCLUDED IN THE ANALYSIS

After having determined what costs and benefits should be inorporated in the analysis and how they should be valued, the next step in CBA is, as far as is possible, to incorporate other factors which may have to be considered in the decision making process. This step takes the form of determining the constraints within which the project functions. The constraints may relate to scarcities, such as limited capital, availability of materials and competent personnel; or to welfare considerations, such as the distribution of income; or to risk and uncertainty.

(iii.1) SCARCITIES

Clearly, scarcity constraints are very important at the project planning stage. The scope of the project must take these factors into account. For example, it is of limited value embarking on a massive educational expenditure program where the competent personnel to execute the programs do not exist. A technique which is commonly used where optimization is sought, given certain constraints, is linear programming. In respect of relevance to CBA, perhaps the greatest limiting factor is the scarcity of capital which manifests itself to the public sector in the form of high social opportunity costs of borrowing or budgetry expenditure ceilings. This often makes some form of capital rationing necessary and one way of achieving this is through the determination of cut-off rates of return where a project is only accepted if it is expected to yield a rate of return to the investment higher than the cut-off rate. (More about this is provided in section (iii.2) of this chapter on discount rates)

(iii.2) WELFARE CONSIDERATIONS - DISTRIBUTION OF INCOME

Over the last half century the Paretian welfare basis for the ranking of different economic situations, for example, before and after a project, have been a centre of controversy. In this section some of the main issues of this controversy are described. As it turns out, whether a cardinal or ordinal approach to the measurement of welfare is adopted, the same conclusions are reached. In both cases it emerges that unless some prior value judgements are made, very little can be said without considerable qualification about alternative economic situations. Beginning with a cardinal approach it is demonstrated that unless one assumes something of the functional nature of the marginal utility of income function, for example, by some 'arbitrary' specification of a social welfare function, ('arbitrarily' determined

by the economist in terms of either his normative values or those he determines from a study of the political mechanisms in society), that one has no basis for socially preferring projects. This is followed by a rough description of the paradoxs inherent in the ordinal approach - the only apparent resolution to these paradoxs lying in the conclusion that welfare superiority can only be determined on the basis of distributional criterion - a conclusion no different to that revealed by the cardinal approach. We begin immediately below with the cardinal utility model.

If an economy contained consumers who had identical utility functions, $U = U(X1...Xn)$, identical incomes Y, and faced the same prices for the same goods, then rationally they would seek to maximise Z (defined below). This simplifies to maximising a utility function $U(X1...Xn)$ where all income is spent on goods Xi, for $i = 1...n$.

We define $Z = U(X1...Xn) - a(Y - \sum_{i=1}^{n} PiXi)$

, where a = marginal utility of income.

This expression is maximized for,

$$\frac{\partial Z}{\partial Xi} = \sum_{i=1}^{n} \frac{\partial Ui}{\partial Xi} - a\sum_{i=1}^{n} Pi = 0$$

$$\text{or} \quad \sum_{i=1}^{n} \frac{\partial Ui}{\partial Xi} = a\sum_{i=1}^{n} Pi$$

$$\text{or} \quad \sum_{i=1}^{n} Pi = \frac{1}{a} \sum_{i=1}^{n} \frac{\partial Ui}{\partial Xi} \text{ , i.e. where price is}$$

equal to marginal utility of consumption divided by the marginal utility of income. Thus, the value of a change in output is

$$\sum_{i=1}^{n} PidXi = \frac{1}{a} \sum_{i=1}^{n} \frac{\partial Ui}{\partial Xi} dXi.$$

If we suppose that the project increases the production of certain goods (1,....,k) at the expense of diverting resources from the production of other goods (k + 1,...,n) then this expression becomes,

$\sum_{i=1}^{k} PidXi + \sum_{i=k+1}^{n} PidXi = \frac{1}{a} \sum_{i=1}^{n} \frac{\partial Ui}{\partial Xi} dXi$, which is negative where,

$\sum_{i=k+1}^{n} PidXi > \sum_{i=1}^{k} PidXi$, (utility is decreased) and positive where,

$\sum_{i=k+1}^{n} PidXi < \sum_{i=1}^{k} PidXi$, (utility is increased). However, it is unlikely that the exact amounts of goods sacrificed can be calculated (i.e. $\sum_{i=k+1}^{n} dXi$) - only the factor inputs(and their prices) which go into goods(k+1,...n), may be known. Thus it may be more meaningful to express

$\sum_{i=k+1}^{n} PidXi$ as $\sum_{j=1}^{m} \sum_{i=k+1}^{n} Pi. \frac{\partial Xi}{\partial Fj} dFj$, where the change in output dXi equals the sum of changes in factor inputs, dFj (j = 1...m) multiplied by the marginal product of each input, $\frac{\partial Xi}{\partial Fj}$. In perfect competition, the marginal revenue product $Pi \frac{\partial Xi}{\partial Fj}$ is equal to the price of factor input, Wj, and we may express,

$$\sum_{i=k+1}^{n} PidXi = \sum_{j=1}^{m} Wj\, dFj$$

,so that the complete maximizing expression becomes,

$$\frac{1}{a} \cdot \sum_{i=1}^{n} \frac{\partial Ui}{\partial Xi} dXi = \sum_{i=1}^{k} PidXi + \sum_{j=1}^{m} Wj\, dFj.$$

This is positive where the value of extra output ($\sum_{i=1}^{k} PidXi$) exceeds the costs of resources diverted into production of this output, i.e. $\sum_{j=1}^{m} Wj\, dFj$. Note that for this analysis to be valid, perfect competition need not necessarily have to exist, all that is required is

that the prices of factor inputs equal their marginal revenue product, which, even under monopolies is possible with suitable government intervention.

Initially it was assumed that all consumers faced identical utility functions and identical incomes. If we relax the latter assumption, that of identical incomes, but not the former, it is still possible to compute the net benefit arising out of a change in output for each individual. But, this will vary for individuals of differing income groups and thus the net benefit, $\frac{1}{a} \sum_{i=1}^{n} \frac{\partial Ui}{\partial Xi} dXi$, will be positive for some consumers and negative for others. Some income groups will not consume certain types of goods at all (eg. light acrobatic aircraft) and thus the net benefit of producing such goods will, assuredly, be negative for many consumers, i.e. in terms of the maximising equation,

$$\frac{1}{a} \sum_{i=1}^{n} \frac{\partial Ui}{\partial Xi} \cdot dXi = \sum_{j=1}^{m} Wj \; d \; Fj < 0.$$

To make an assessment of the overall effect on such a project it becomes necessary therefore to make value judgements about its distributional effects - the positive net benefits must be weighed against the negative net benefits. One means of reducing the normative content implicit in this approach is by the adoption of a social worth (S W) function, where a project is valued at the maximum sum of cardinal utilities across t individuals, i.e.

$$SW = \sum_{h=1}^{t} Uh$$

$$dSW = \sum_{h=1}^{t} \sum_{i=1}^{n} \frac{\partial Uih}{\partial Xih} \cdot dXih$$

$$= a \sum_{h=1}^{t} \sum_{i=1}^{n} PidXih$$

The subscript h denotes the individual with whom the utility function and consumption of Xi are associated, and a is the marginal utility of income which is assumed constant

for all individuals. If a varies across individuals the function becomes,

$$dSW = \sum_{h=1}^{t} \sum_{i=1}^{n} a_h \, PidXih$$

and the change in social worth becomes the sum of net benefits weighted by the marginal utility of income for the particular income group. The essential problem with this approach, is that determining differences on the marginal utility of income have not proved very successful so far.[35]

However, the equation does provide a basis on which the motivation for differential weighting can be built. If we are guided by the hypothesis of the diminishing marginal utility of income then we would expect $a_h > 0$ and $\frac{da_h}{dy} < 0$. One function which exhibits such properties is the Bernoulli[36] form of utility function,

$$Uh = -A^{1-B} Yh^{B}$$

, where Uh = utility of income group h; h = 1...t

Yh = income of group h,

and A and B are arbitrary parameters; $A > 0$; $B < 0$, which are fixed by policy decisions. Thus $a_h = -B A^{1-B} Yh^{B-1}$, and using the World Bank[37] recommendation that B = -1 and A = $\bar{Y}$ = mean income across the group or region; whichever is applicable, this yields, $a_h = \frac{(\bar{Y})}{Yh}^2$. This provides a basis in CBA for the application of differential weighting to the cost and benefit effects experienced by each income group or income region as a result of a project. Clearly, the setting of B always involves a value judgement by someone. Even if the progressive income tax schedule is taken as a basis for determining B, this qualification is not overcome as these progressive rates are the outcome of deliberate government policy decisions. Therefore, this approach unavoidably involves inter-personal comparisons of utility.

A completely different approach to assessing the social worth of a project is provided by the Hicks - Kaldor[38] compensation test, which does not require interpersonal utility comparisons but does not, unfortunately, always yield conclusions compatible with Pareto improvements in welfare. By their hypothesis if the beneficiaries of a project remained on a higher indifference curve after compensating the losers from a project sufficiently to return the losers to their original indifference curve then a project initiates a Pareto improvement in welfare. It follows that if compensation (by taxes and subsidies) is not accomplished then the project may only be said to hold the potential for a Paretian improvement in welfare. However, even if compensation is paid, their assertion that this was a sufficient condition for a Paretian improvement in welfare, is not completely valid because the income distribution may well have changed as a result of the project (the Scitovsky paradox[39]) such that the only way to improve welfare would be to abandon the project. This is illustrated in figure 1.6.

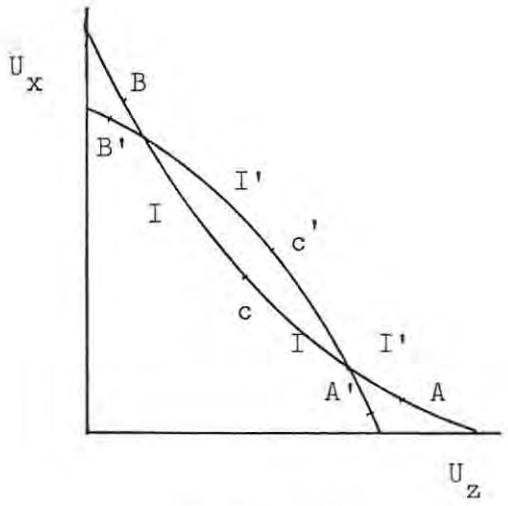


Figure 1.6

Let Ux and Uy represent the utility possibilities for consumers X and Z respectively. I, represents the combinations of utility open to X and Z, given different distributions of income, if a project is implemented and I' represents similar combinations which are possible if the project is not implemented. If the income distribution is such that the utility combinations in the economy are represented by either points A' or B', then it is possible by the compensation of losers, to increase the utility of at least one consumer without decreasing anothers, i.e. moving to points A and B respectively, on I. However, it is possible that after the project but before compensation, the income distribution had shifted the consumers to point C, i.e. a point where it is not possible for the gainers to compensate the losers and still experience an improvement in welfare unless the project is abandoned. The reason for this is that a Pareto improvement in welfare would arise if the losers were compensated such that a combination such as C' was obtained. Hence the paradox - before the project is carried out the compensation criterion suggested that the project would lead to a Pareto improvement in welfare, but immediately after the project was implemented the compensation criterion suggested the reverse, i.e. a Pareto improvement in welfare would be obtained by abandoning the project.

Various attempts have been made to obviate this problem caused by a shifting in the distribution of income. The Scitovsky criterion, for example, emerged out of the demonstation of the paradox requiring that the ranking of two positions should be the same after the redistribution effects of a project had been taken into account. Following this Little[40] initiated the 'dual criterion' approach, which advocated that wherever actual compensation was not possible that both compensation and a distribution tests be applied to social ranking. This amounted to satisfying (I) the Hicks-Kaldor criterion, in that the

'gainers' could potentially more than compensate the losers, (II) the Scitovsky criterion, in that after the project the 'gainers' could not potentially compensate the 'losers' to abandon the project, (the implication of (I) and (II) being that potentially someone was better off without anyone else being worse off by the change i.e. it was Pareto preferred), and (III) a distribution criterion, in that after the project the distribution should be no worse than that which pertained before the project (i.e. it was distributionally preferred). However, this too yielded a paradox - consider, for illustrative purposes, Mishan's[41] utility space constructions in his essay "Welfare Criteria: Resolution of a Paradox".

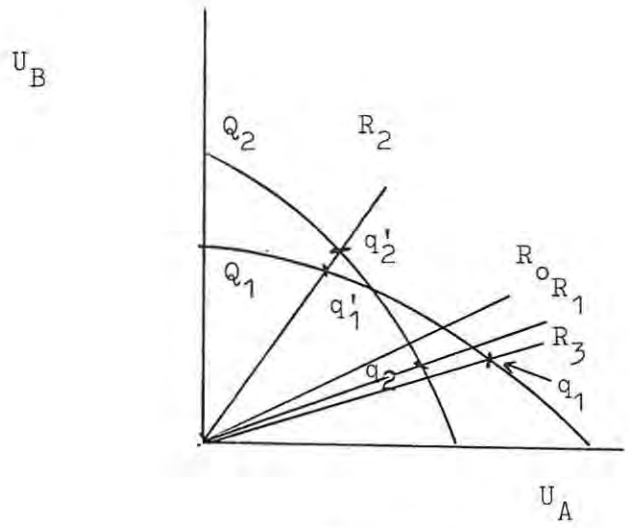


Figure 1.7

In figure 1.7 above, Q_1 and Q_2 describe the utility possibility curves as between two persons, A and B, corresponding to two different collections of goods. The cardinal utility approach implied by figure 1.7 is used for its expositional advantages. Letting, p stand for

Pareto - preferred (i.e. that (I) and (II) from the Little criterion are satisfied), d stand for distributionally preferred(i.e. that (III) of the Little criterion is satisfied), and society rank distributions along the utility possibility curves such that R_o is the best of all possible distribution rays and of the other distribution rays R_1 is preferred to R_2 which is preferred to R_3, (i.e. R_1 d R_2 d R_3), it follows that q_2 d q_2' p q_1' d q_1. However, clearly q_1 p q_2 and hence the paradox. Mishan's 'resolution' to this paradox was to propose the attachment of any two points in the utility space, which are to be compared, with a hypothetical utility possibility curve arising from a hypothetical (new) collection of goods (Q_3 in figure 1.8 below) - a possibility he demonstrates is 'legitimate' in a commodity space with the aid of an Edgeworth box.[42] In figure 1.8 below three different utility possibility curves are depicted corresponding to collections of goods Q_1 and Q_2 and 'hypothetical' collection Q_3 (the dashed utility possibility curve).

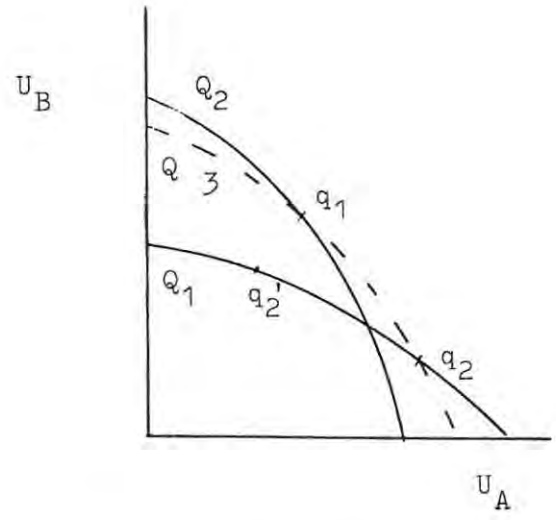


Figure 1.8

The ranking of alternative possible distributions, say q_2 and q_1, arising from a before and after project situation then reduces strictly to a societal distributional preference - the conclusion, therefore, is not unexpected.

> "To sum up, the content of our conclusion is negative but useful for all that. It bids us waste no more time and energy in seeking ways to rank 'contradictable' alternative positions on an allocative scale, and to resign ourselves to the fact that they can be ordered only on a distributional scale." 43

In the light of the above analysis it is easy to understand why Public Policy makers would not wish to rely on Paretian criterion to guide decision making - it is inconclusive and it fails to account for the political and social forces they are voted to consider. We have, however, suggested a mechanism by which these forces could be incorporated into CBA, namely by recourse to distributional weighting - an approach we motivated with the aid of the hypothesis of the diminishing marginal utility of income. Of course, the distributional criteria do not have to be incorporated into the CBA - the authorities could, if they wished, merely specify that the distributional implications be weighed alongside the CBA results in a project decision matix. However, the loss of precision implicit in this approach does not recommend it as much as direct incorporation in the CBA, where, given certain explicit value judgements,it may (as FitzGerld[44] demonstrates) neatly be integrated into the CBA component of the decision matrix.

(iii 3.) RISK AND UNCERTAINTY

In this section some implications of the introduction of risk and uncertainty are introduced into the analysis. It is shown in a risk context that, where a diminishing

marginal utility hypothesis underlies the income-utility relationship, a case for incorporating risk 'costs' in the CBA can be made, (though by the Arrow-Lind[45] and Fisher[46] theorems we restrict validity of this result to public goods), but in an uncertainty context, that one must adopt a completely different approach - one of applying 'suitable-to-the-situation' decision criteria. The difference between these concepts is usually taken to be, that in the case of risk, statistical probabilities can be assigned to events, whereas in the case of uncertainty no probabilities can be assigned to an event. The bulk of this section is taken up with the implications of risk but some consideration is also given to possible guiding criterion under uncertainty.

A decision maker's action may be characterized by risk-neutrality, risk-preference or risk-aversion. Given various expected outcomes with assigned probabilities, a risk-averter would weight relatively more heavily the negative outcomes than positive outcomes, a risk-preferer would weight relatively more heavily the positive outcomes that negative outcomes and a risk-neutral decision maker would equally weight the expected outcomes. In this analysis the objective function which we argue a decision maker would wish to maximize is that of the expected utility (E(U)) of money outcomes (Yi; i=1....n) of a project. This objective function may be expressed as below:

Max E (U) = $W_1P_1\ U(Y_1) + \ldots + WnPn\ U(Yn) = \sum_{i=1}^{n} WiPi\ U(Yi)$, where Pi = the objective probability associated with Yi outcome ($\sum_{i=1}^{n} Pi = 1$), Wi = the subjective weight attached by the decision maker on the Yi outcome ($\sum_{i=1}^{n} Wi = 1$), and U (Yi) is the utility derived from that Yi outcome. For the purpose of analysis suppose that there were only two possible outcomes, Yi and Y(i + 1),(the analysis may easily be extended to cover a greater number of outcomes without altering the main results) and let Wi be absorbed into Pi such that,

$$E(U) = P1\ U(Yi) + P2\ UY(i + 1)$$

,where $0 \leq P1 \leq 1$ and $P2 = 1-P1$ and $P1 = W1P1$.

This yields, for example, an

$E(U) = U(Yi)$ at $P1 = 1$

and $E(U) = U(Y(i + 1))$ at $P1 = 0$.

Indeed, given P1 (the subjectively weighted probability outcome) the (income; expected utility) outcome readily follows and maps a linear relationship between the two alternative outcomes as is illustrated in figure 1.9 below.

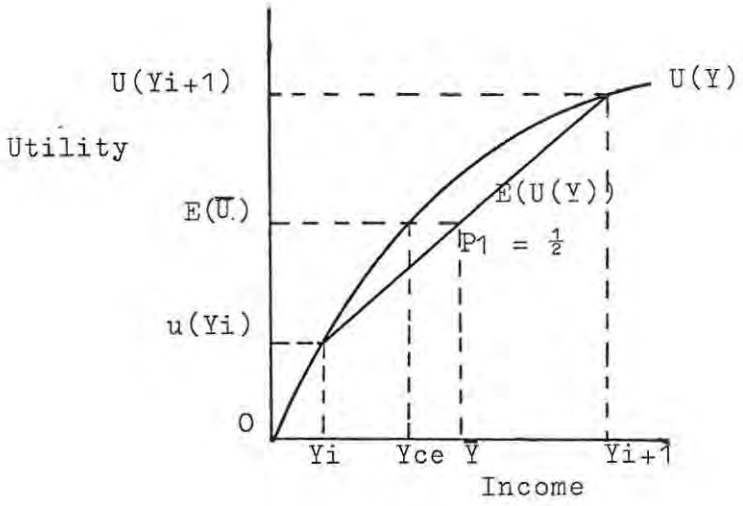


Figure 1.9

In figure 1.9, the two functions U(Y), (which we assume to exhibit positive but diminishing marginal utility, i.e. $\frac{dU}{dY} > 0$; $\frac{d^2U}{dY^2} < 0$), and E(U(Y)), which exhibits linearity over Yi to Y(i + 1), are shown. Now at $P1 = \frac{1}{2}$ on the E(U(Y)) function the $(\bar{Y};E(\bar{U}))$ combination, results. But at that same level of utility, E(U), we find income Yce associated from the U(Y) function. The reason for the

difference is a result of the introduction of risk. This leads us to the idea of what the cost of risk-bearing (CRB) is, namely the difference between the 'certain' income outcome as reflected on the U(Y) function and the risk bearing income outcome as reflected on the E(U(Y)) function, where the utility yielded from the certain income outcome equals that derived from the risk bearing income outcome, i.e. at E(U(Y)) = U(Y). Clearly for the situation depicted in figure 1.9 the CRB = $\bar{Y}$ - Ycè where Ycè is the certainty equivalent yielding utility income of $\bar{Y}$.

One way of incorporating the CRB in the CBA is to distinguish between the expected net social benefit (NSB) and the certainty equivalent NSB, such that

$$NSBce = NSB - CRB$$

, where NSBce = certainty equivalent NSB.

As the CRB is spread out over the project life, it has to be discounted to present values so that it may be subtracted from the NSB, which is a present valued quantity. Letting the discounted CRB be $PV(CRB) = \sum_{t=o}^{T} \frac{CRBt}{(1+r)^t}$

we have $NSBce = NSB - \frac{CRBt}{(1+r)^t} = \frac{Bt - Ct - CRBt}{(1+r)^t}$.

More elaboration on the discounting process is provided in the next section. Unfortunately, the same problem arises out of the measurement of the CRBt as did for the measure of consumer surplus - it is based on a specific knowledge, of the utility function which is a subject upon which there is not a great deal of agreement. Nevertheless, if risk is relevant, then some estimate of the CRBt, arguably, should be incorporated in the CBA.

The above analysis is certainly applicable to the private firm, but a question is raised by the Arrow-Lind Theorem[47] as to whether risk is relevant to all government decision making. Their basic argument is the greater the number of people (taxpayers) sharing the risk the less the risk is to the individual (taxpayer). Thus, the risk to the

individual of public investments, because of the large tax base, is trivial and can be ignored. This may be illustrated graphically - see below.

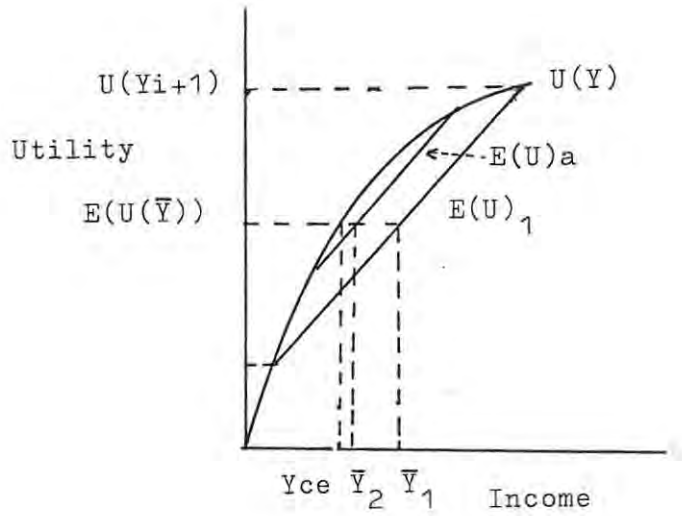


Figure 1.10

The above figure depicts a diminishing marginal utility function for the society (assume for simplicity that all taxpayers have the identical utility function U(Y) and expected utility outcome lines $E(U)_1$ and $E(U)_2$. If there was one individual bearing the risk of possible utility outcomes U(Y(i + 1)) or U(Yi) then the CRB to the individual to certainly realise a utility of E(U(Y) would be $\bar{Y}_1$ - Yce. However, when other individuals are included in bearing the risk of gains and losses, the maximum possible gain or loss to the individual declines, eg. from $E(U)_1$ to $E(U)_2$ at which the CRB = $\bar{Y}_2$ - Yce which is less than $\bar{Y}_1$ - Yce. As the risk is spread over a greater number of people so the CRB = $\bar{Y}_n$ - Yce, tends towards zero and can be ignored.

Fisher [48] has disputed the validity of the Arrow-Lind theorem for public goods by virtue of their non-excludability. The risk may not be split for these goods because the presence of other individuals in no way reduces a particular person's risk exposure, eg. for defence projects or anti-polution projects. This argument may be of limited relevance to education also however, as education has strong private good characteristics.

Another argument for ignoring risk for public projects relates to risk-spreading. Where the government is involved in a great number of separate projects, none of which dominate the whole portfolio, then the risk of losses for a particular project could arguably be balanced by the concurrent potential of securing higher than expected net benefits from other projects. However, it is unclear whether education projects are sufficiently independent from other projects or sufficiently small to be classified as risk free by this argument.

In many cases an uncertainty context is more relevant than a risk context as the probabilities of possible outcomes are not known. In the remainder of this section some decision rules are outlined which could be adopted by the decision maker under these conditions.[49] The decision criteria are outlined in the context of a pay-off matrix, which for this illustration assumes,(a) there are three possible states which could occur with an unknown probability, (S = 1,2, 3), (b) there are three possible projects, (P = 1,2, 3) and (c) the NSB accruing to each project is known given the occurrence of a particular state, S (or at least some index of the NSB). In the pay-off matrix which is shown on the following page indexes are used as a proxy for the NSB.

		S		
		1	2	3
P	1	3	0	2
	2	1	1	1
	3	0	4	0

A Pay-off Matrix

Using this matrix as a basis, four possible criterion are listed below, which could be used to guide the decision maker faced with uncertainty.

(a) The decision maker could be guided by a 'Maximax' criterion, i.e. the strategy yielding the highest payoff possibility, P = 3 is selected.

(b) He could be guided by a 'Maximin' criterion, i.e. maximise the minimum payoff possibility, P = 2 is selected.

(c) He could argue that as no probabilities are known that equal probability should be allotted to each possible outcome of the project and the project yielding the highest summed expected value should be chosen (the 'Laplace' criterion), P = 1 is selected.

(d) He could construct a 'regret' matrix where the regret is the difference between the actual payoff and the maximum payoff that would have been possible had the best project been chosen and then minimise the maximum regret that would have been possible (the 'Minimax Regret' criterion), P = 2 or P = 1 is selected.

(IV) THE DISCOUNT RATE

The discount rate serves two purposes - it is an indication of the social opportunity cost (SOC) of capital and it is an indication of societies time preference rate (STPR), i.e. an

indicator of their strength of preference for present consumption over future consumption. In this section we look firstly, at this dual function of the discount rate, secondly at these functions against a background of differing roles played by the State in the economy (i.e. the supportive or controlling roles of the State), thirdly at the discount rate from the perspective of the investment criterion and finally, at the determination of the discount rate in the application of CBA to education.

(IV.1) THE DUAL FUNCTION OF THE DISCOUNT RATE

In this section it will be demonstrated that there are two alternative approaches to the derivation of a discount rate based on its dual functions - the costing of capital approach or the reflecting societies time preference of consumption approach. In conclusion it is shown that it is unlikely that these two rates will be equal.

In order to derive the SOC of capital a simple model of two periods, t and (t+1) is used, where the consumption in period (t+1)., namely C (t+1), is a function of consumption in the previous period, namely Ct. The expectation is that there will be a negative relationship between consumption in these two periods because what is not consumed in period t is saved and invested which leads to a greater consumption in period (t+1). From the given function $C^{(t+1)} = f(Ct)$ we can, therefore, deduce the following about $\frac{d\,C^{(t+1)}}{d\,Ct}$,

(a) it is negative and

(b) it exceeds unity.

If in addition we argue that it exceeds unity by constant, r, then it follows, $\frac{d\,C(t+1)}{d\,Ct} = -(1 + r)$, where r is the amount of extra consumption yielded in period (t+1) because of the increased availability of capital which came about through the sacrifice of consumption in period t. This r is variously called the SOC of capital, the

marginal efficiency of capital (Keynes[50]), or for CBA purposes, the internal rate of return (I RR).

In the above analysis the preferences of society were ignored. We now consider the implications of the hypothesis that society may derive different utility from consumption in different periods, or put more specifically, that society may prefer present consumption to future consumption. In utility terms, where U is utility,

$$U = f(Ct;\ C(t+1)).$$

We now ask what relationship we could expect between consumption over these two periods given an unchanged level of utility. This would be reflected in the partial derivative;

$$\frac{\partial C(t+1)}{\partial Ct} = \frac{\partial U}{\partial Ct} \cdot \frac{\partial C(t+1)}{\partial U} = \frac{\partial U}{\partial Ct} \Big/ \frac{\partial U}{\partial C(t+1)} \quad \text{(by the chain rule).}$$

The sign of this relationship is negative because, the assumption of an unchanged utility level implies $dU = 0$ which in turn implies $\frac{\partial U}{\partial Ct} + \frac{\partial U}{\partial C(t+1)} = 0$, i.e. that $\frac{\partial U}{\partial Ct} = - \frac{\partial U}{\partial C(t+1)}$. The numerator and denominator thus have opposite signs and we may conclude $\frac{\partial U}{\partial Ct} \Big/ \frac{\partial U}{\partial C(t+1)} < 0$, as asserted. If we now assume $C(t+1) > Ct$ through investment and accept the hypothesis of diminishing marginal utility to incremental consumption, it may be deduced that $\frac{\partial U}{\partial Ct} > \frac{\partial U}{\partial C(t+1)}$, and thus similarily to the case for the SOC, we could write $\frac{\partial U}{\partial Ct} \Big/ \frac{\partial U}{\partial C(t+1)} = - (1 + S)$, where S is a function relating marginal utility between periods. Other reasons why $\frac{\partial U}{\partial Ct}$ may exceed $\frac{\partial U}{\partial C(t+1)}$ could be risk of death or purely because people just prefer present to future consumption and do not seek to maximise welfare over their full lifetime. It is S, then, which equates consumption over different periods and as such is referred to as the STPR.

As r is free to vary on an efficient capital market, savings behaviour should always ensure that $r = S$.

If S > r, then some individuals in the society would be motivated to save less, as they would prefer current consumption to future consumption increases, and r would increase to equal S, and vice versa for r > S. Unfortunately, this does not seem pertain in practice - the financial markets are not characterised by a single rate of interest but rather by many different rates. Some reasons for this are, differences in risk, the inadequacy of capital markets, the existence of externalities and direct taxation, eg. taxation on dividends.[51] The latter would, for example, reduce the motivation to save and thus push r > S.

(IV.2) FUNCTIONS OF THE DISCOUNT RATE AND THE DIFFERING ROLES OF THE STATE IN THE ECONOMY

The function of the discount rate in the planning process corresponds to the nature of the role played by the State in the economy. This can be supportive or controlling. Where a supportive role is dominant then the Sate orientation is toward contributing to private sector performance in such a way that it does not diminish the private sector. Where a controlling role is dominant the State orientation is toward participation in the economy so that it can determine the path of development.

Where the State plays a supportive role, it is implied that the cost of funds obtained by the State from the private sector should be determined by the opportunity cost of these funds to the private sector, in other words, by the rate of return to private capital at the margin. This raises two issues. (a) If the State appropriates (borrows or taxes) funds from the private sector, does this imply an equivalent reduction in funds available for private sector investment or are a part of these funds a consumption component of income? (b) Are measures for S and r really determinable? Firstly, we

tackle the question of whether S is determinable from the hypothesis of diminishing marginal utility of consumption and secondly, the question of whether a single rate of interest is determinable from the constellation of market interest rates, which bears a close relationship to the marginal productivity of private sector investment and yet incorporates the long term relatively risk free environment which face many public sector investments, especially in the provision of private goods and services.

The first issue questions the rationale that a State appropriation of funds is equivalent to a reduction in funds available for private sector investment. Clearly this need not necessarily follow, as a portion of these funds may represent consumption foregone in the private sector. A similar problem arises in the analysis of the 'investment' expenditure on public projects - this expenditure may well have investment and consumption components. If the STPR and the SOC were equal, this would not matter, but given (see section (IV.1)) that they differ, we are faced with two alternatives - to separate entirely the investment and consumption components and apply the different rates to these components, or alternatively to determine a formula, using a weighted average of STPR and SOC rates, which is based on some rough division between consumption and investment, to apply to the discounting of public expenditure - the so-called 'synthetic' approach.[52] Even with the synthetic approach, some separation of the investment and consumption sources in public expenditure is necessary and similarily, some separation of the investment and consumption consequences of the public expenditure is necessary. Unfortunately this has to be rather arbitrary and as a result the discounting formula produced is unconvincing. Marglin's[53] approach, as outlined below, is a major contribution in this field, and serves to illustrate many of the above points.

A project is defined as advantageous to society where the NPV $>$ 0, or stated another way, where the present value of benefits exceeds the present value of costs, i.e.

$$\sum_{t=0}^{n} \frac{Bt}{(1 + S)^t} > \sum_{t=0}^{n} \frac{Kt}{(1 + S)^t}$$

, where Bt = benefits, Kt = costs of the project and S = STPR. Marglin differentiates the cost according to the source of finance. That part of the cost of a project which is financed by taxes is said to be at the expense of consumption foregone and that part of the cost of a project which is financed by borrowing is said to be at the expense of private investment foregone. The component funds for the project, namely borrowing and taxes thus make up the full cost, i.e. Ko = Io + Co where Io represents investment foregone and Co represents consumption foregone at t=o. To find the equivalent value of these funds in years (0,1,...n), the investment component is compounded at r (the SOC) and the consumption component is compounded at S, i.e.
$Kt = Io\ (1 + r)^t + Co\ (1 + S)^t$, where Io = finance from borrowing and Co = finance from tax. The present value of costs then becomes,

$$\sum_{t=0}^{n} \frac{Kt}{(1 + S)^t} = \sum_{t=0}^{n} \frac{(Io\ (1 + r)^t + Co\ (1 + S)^t)}{(1 + S)^t}$$

$$= \sum_{t=0}^{n} \frac{Io\ (1 + r)^t}{(1 + S)^t} + Co$$

On the benefit side Marglin assumes that a fraction of the benefits, b, accrue as reinvestable cash flows and the remainder, 1 - b, is a consumption benefit which cannot be reinvested. Thus, the full benefit of a project equals, $b\ Bt(1 + r)^t + (1 - b)Bt$

, where the reinvestable part of the benefit is compounded over the life of the project at the SOC rate, which equals r. The present value of benefits thus becomes,

$$\sum_{t=0}^{n} \frac{Bt\ (b(1 + r)^t + (1 - b)}{(1 + S)^t}$$

and the NPV $>$ 0 condition becomes,

$$\sum_{t=0}^{n} \frac{Bt\ (b\ (1 + r)^{t} + (1 - b))}{(1 + S)^{t}} > \sum_{t=0}^{n} \frac{Io\ (1 + r)^{t}}{(1 + S)^{t}} + Co.$$

There are however problems with this approach. One is the initial assumption that all taxes are consumption foregone and all borrowing is investment foregone - clearly this need not be valid. Another problem arises if a portion of the benefits are reinvested in perpetuity - this leads to the present value of benefits growing at rate $\frac{(1 + r)^{t}}{(1 + S)^{t}}$ in perpetuity and the NPV becomes infinite if $r > S$.

The second issue we tackle, in respect of the supportive role of the State, is the determinability of the r and S rates.

In section (IV.1) we determined that,

$$\frac{\partial U}{\partial Ct} \Big/ \frac{\partial U}{\partial Ct + 1} = -(1 + S).$$

If we allow the marginal utility of consumption function to have a constant elasticity form such that,

$$\frac{\partial U}{\partial Ct} = a\ Ct^{b}$$

, where a and b are constants, $b < o$ and equal to the elasticity of the marginal utility with respect to Ct (consumption per head), i.e. $\frac{\partial U}{\partial Ct} \cdot \frac{\partial Ct}{\partial U} = b$, this implies that,

$$-(1 + S) = \frac{\partial U}{\partial Ct} \Big/ \frac{\partial U}{\partial C(t+1)} = -\frac{a\ Ct^{b}}{a\ C(t+1)^{b}} = -\left(\frac{C(t+1)}{Ct}\right)^{-b}$$

$$= -\left(1 + \frac{C(t+1)-Ct}{Ct}\right)^{-b} = -(1 + f)^{-b}$$

, where f = rate of growth in consumption per head from t to t + 1. Simplifying for S we get,

$$S = (1 + f)^{-b} - 1.$$

The basis on which the STPR is determinable immediately follows, namely, a value judgement based on the hypothesis of the diminishing marginal utility of consumption, (which underlies the policy constant b), and the rate of

growth in consumption (which is defined as f above). With respect to the determinability of r it can be observed that a popular choice is the government borrowing rate because of its long term, risk free nature and the fact that it actually does represent the financial cost of government expenditure. The use of the government borrowing rate for r does, however, amount to an expression of great faith in the effectiveness of capital markets to accurately reflect the opportunity cost to society of investible funds, which given the segmented nature of capital markets (even in the more developed capitalist economies) seems unlikely[54].

To sum up, where the government perceives its role as supportive, it is tempting to deduce that the discount rate appropriate to estimating the worth of the various public projects is the SOC of capital. However, this ignores the simultaneous presence of consumption and investment components in public financing and expenditure activities. Unfortunately, these components are not completely separable which has given rise to 'synthetic' discounting approaches where both the SOC and STPR are incorporated into the discounting formula - the STPR being estimated, perhaps, on the basis of a diminishing marginal utility hypothesis and the SOC of capital being estimated, perhaps, from the government borrowing rate.

In the discussion above we assumed a supportive role for the State,which implied that the State restricted its activities to those in the interests of private enterprise. We now discuss the implications of a controlling role which implies far less restriction on the State. The State, in this case, seeks to influence the path of economic development and would regard its only restriction as the size of the budget,which would be constrained by 'prudence' in a broad fiscal policy sense.

The State could set the budget size at what the private sector could bear, the "taxable capacity" level as Musgrave[55] calls it, but this extreme may differ substantially from a "fair" or an "optimal budget size ". It seems rational though, that where the State perceives its role as a controlling one, that it will be inclined towards this extreme by virtue of the necessity of the public sector to be of sufficient size if it is to strongly influence the path of development. For the purposes of CBA however, interest may be restricted to the fact that budgetry allocations will be constrained, and not in matters such as what determines the optimal budget size or the taxable capacity. Therefore, the financing and size of the budget are taken as exogenous to the CBA. From a CBA angle the focal point of consideration is, given a budgetry ceiling, what adaptions are necessary to allow for this constraint in the project appraisal.

It is not possible, except where an error of judgement has been made, for the total worth of the projects proposed to be less then the budgetry ceiling because a budget allocation is a response to specific motivated requests for funds. If the budgetry allocation was equal to the total cost of projects proposed, then there would be no allocative problem and project analysts would merely, 'ex ante' budget, test whether the total benefits exceeded the total costs of the various projects. What is much more likely than the above scenario's is that the budget allocation would be less than the cost of proposed projects. CBA offers a framework for social optimization where this is the case. The NPV's for all the projects are derived (see section IV. 3) and from these and the various project capital costs (K), cost-benefit ratios (CBR) are determined where,

$$CBR = \frac{NPV + K}{K} = \frac{NPV}{K} + 1$$

Clearly, where $NPV > 0 \Rightarrow CBR > 1$ and the condition for

optimal allocation of public expenditure becomes,

$$\text{Max} \sum_{i=1}^{n} \text{CBRi} = Z$$

, where i denotes the various projects and Z denotes the budgetry ceiling.

(IV.3) THE DISCOUNT RATE FROM THE PERSPECTIVE OF THE INVESTMENT CRITERION

In this section we look at the two basic investment criterion used in CBA, namely NPV and IRR, at reasons for a possible divergence of results between the two criterion, at alternative specifications of the discount factor over time and at three other decision criterion, namely the maximum pay back horizon criterion, the normalised net terminal value (NTV) criterion and the normalised IRR criterion.

One way of expressing the NPV is,

$$\text{NPVj} = \frac{\text{Xoj}}{(1+r)^0} + \frac{\text{Xij}}{(1+r)^1} \cdots + \frac{\text{Xnj}}{(1+r)^n} = \sum_{t=0}^{n} \frac{\text{Xtj}}{(1+r)^t} ,$$

where NPVj = net present value of project j,
Xtj = Bt - Ct = benefit in year t minus costs in year t of project j, and $(1 + r)^t$ is the factor by which each net benefit, Xt, is discounted. Estimates of these relating to different t and r are available in discount table form. On its own, a project is socially acceptable where NPVj $>$ 0. Where there is no budget restraint, all such projects would be accepted, but where there is a budget restraint, CBR's would be used to maximise the NPV across various non-interdependent projects (see previous section (IV.2)). The other major NPV criterion, the IRRj is defined as rj, where NPVj = 0, i.e. rj in the equation, $0 = \sum_{t=0}^{n} \frac{\text{Xt}}{(1+rj)^t}$.
A project is acceptable where rj $>$ 0 and given two non-interdependent projects, the one with the highest rj is accepted before the one with a lower rj. There are two conditions which must however, hold if this criterion is to be used:-

(a) absolute undiscounted returns $>$ absolute undiscounted costs.

(b) there must not be more than one change in the sign of the Xt profile otherwise it can be shown that it is possible that there is no unique r at NPV = 0 by Descartes' Rule, which states that the number of roots to the decision formula equals the number of changes in sign of the net benefit .

One may be tempted to believe that the two criterion are interchangeable, both yielding the same result, but this is not the case. Consider two projects A and B, non-interdependent, but both vying for the same scarce funds, with NPV-discount curves as depicted below:

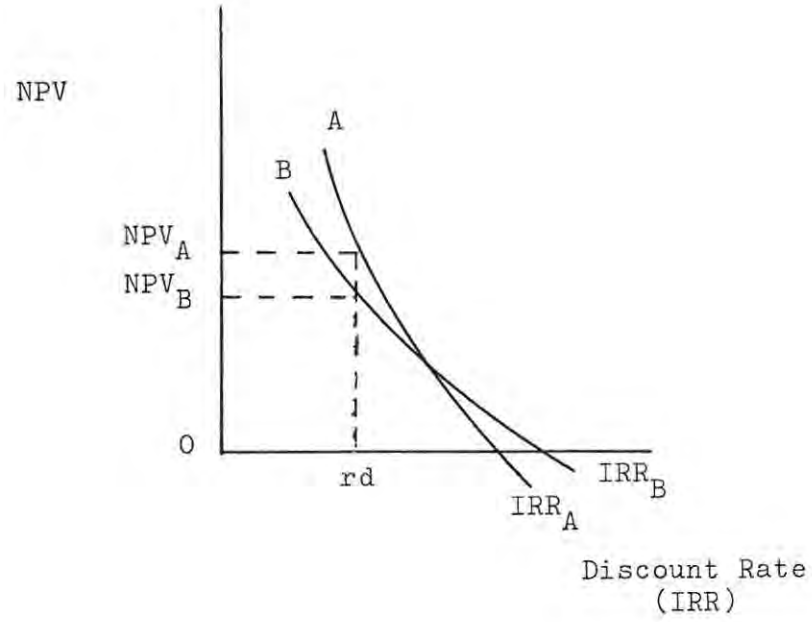


Figure 1.11

Clearly, the two criterion yield different decision results given that for NPV computational purposes rd is taken as the discount rate. Using NPV criterion, A is preferred to B because $NPV_A > NPV_B$ at rd, but using IRR criterion, B is preferred to A because $IRR_B > IRR_A$.

The conventional discount term, $dt = \frac{1}{(1+r)t}$, is based on the opportunity cost of capital argument or the social time preference argument and the principles of compound interest. It may be shown by way of demonstration, that an amount is invested now, P, earning compound interest of r over ten years, would grow to A, such that,

$$A = P\ (1 + r)^{10}.$$

Arguing in reverse, we could ask what A received in 10 years time would be equivalently worth in the present, bearing in mind that it could earn a compound rate of interest of r. Clearly, it is equivalently worth P, i.e., $P = A.\ \frac{1}{(1+r)}10$. In general, $P = A\ \frac{1}{(1+r)}t = Adt$; $dt < 1$ (and thus $P \rightarrow 0$ as $t \rightarrow \infty$). The situation is not so clear though, if we argue that individual preferences alone should determine the relationship between A and P, as it is conceivable then, that dt would not be less than unity. If people are really indifferent between consumption now or consumption later, then dt = 1, i.e. r = 0. If people are altruistic in respect of future generations, then $dt > 1$, i.e. $r < 0$. Pigou argues that, in fact, too little weight is normally given to future genenerations consumption, that society sets dt too low, and that government intervention may be necessary to give adequate weight to the interests of unborn generations.[56]

Finally, what of the other three decision criterion mentioned. The first is a kind of rule of thumb, the maximum payback horizon method. An arbitrarily established investment period is set over which benefits must exceed costs if a project is to be accepted. This is not however, a very scientific method and, a result inconsistent with maximizing NPV may quite possibly emerge from using this method. The second approach considered is the normalized net terminal value criterion, where instead of discounting all Xtj back to present value, they are compounded forward to terminal values of the project (if such a project

life-span is determinable). For the use of this approach all costs and benefits being analysed, relevant to the project's, must be 'normalized'. Mishan [57] has suggested how this may be done:-

(a) A common project terminal period is selected.

(b) Cost outlays (total) are equalized by proportional adjustment to project costs for each particular year. This has the effect of eliminating the need for CBR's.

(c) A STPR is used to compound consumption benefits to terminal values and the SOC of capital is used to compound any reinvestable funds which accrue in the project, to terminal values, that is, if one can separate these effects .

The summed benefits are then compared with the summed costs and a normalized net terminal value (NTV) reflects the difference. The optimizing condition for project appraisal becomes, Max $\sum_{i=1}^{n} NTV_i = Z$ = the budget allocation for projects ($i = 1,..n$). The third decision criterion, the normalized IRR, is determined from the present value of expenditure on a project, PV (K), which is taken to represent the initial project investment, and the compounded sum of benefits at the termination of the project, TV(B). The normalized IRR equation may be expressed in the form,

$$PV(K)(1+r'_j)^n = TV(B)$$

$$\text{,or} \quad (1+r'_j)^n = \frac{TV(B)}{PV(K)}$$

$$\text{and thus } r'_j = \sqrt[n]{\frac{TV(B)}{PV(C)}} - 1.$$

, where r'_j is defined as the normalized IRR for project j. It has the advantage of having no multiple roots problem, being very similar to the common notion of an average rate of return and yielding results totally consistant with the normalized NTV approach. Certainly, Mishan's approach has very real advantages, but it appears

that the majority of analysts still use NPV techniques and that the NPV approach, suitably adjusted, yields the same results as the TV approach anyway.

(V.) RATE OF RETURN ESTIMATION IN THE FIELD OF EDUCATION

In this section attention is given, to the particular NPV criterion used in the field of education, to the adjustments which can be made to the criterion and, to how the IRR may be approximated by the statistical estimation of earnings functions. The brief mention of the latter approach is necessitated by virtue of the fact that most of the recent studies on rates of return to education use this approach, and because of this, reference to it in the following chapters is unavoidable.

(V.1) THE NPV CRITERION USED IN THE FIELD OF EDUCATION

The application of CBA in the field of education is frequently termed, rate-of-return analysis, because the most popular NPV criterion is the IRR. This is presumably because of the (supposed) ready comparability of the IRR across various investments. Generally speaking the problems of interpreting the IRR, arising out of the dual functions of the discount rate and the potential conflict with other NPV criterion are not focal points of discussion in the application of CBA to education. (Not that this implies any less significance to these considerations, of course).

The benefits of educational investment are determined from the difference in earnings arising between cohorts (groups) of workers of the same ages but differing in educational attainment. An exploration of the theoretical basis for this is a major part of the subject of Chapter 2. The costs of educational investment consist of those expenses incurred directly in obtaining the education, together with those earnings foregone by the individual during the period over which the education takes place (indirect costs).

The latter emerge as the predominant cost, the more advanced the educational level being undertaken.

As with any CBA, the criterion can be applied from a private or social perspective. A private rate of return on education uses after-tax earnings (for measures of benefit and indirect costs) and direct costs of education outlays to the individual in its calculation, whereas a social rate of return uses pre-tax earnings (for measures of benefit and indirect costs) and the direct costs of education as borne, both by the individual and by the government (subsidy), in its calculation.

A common alternative way of expressing the IRR equation described in section (IV.3) is to separate the costs and benefits, i.e.

$$0 = \sum_{t=0}^{n} \frac{Xt}{(1+r_j)}t, \quad \text{where } r_j = \text{IRR and } Xt = Bt - Ct,$$

may be expressed equivalently,

$$\sum_{t=0}^{n} \frac{Ct}{(1+r_j)}t = \sum_{t=0}^{n} \frac{Bt}{(1+r_j)}t \ .$$

To illustrate the use of this formulation, consider the calculation of private and social rates of return to secondary education. Let W_p and W_s be the after-tax wages of primary and secondary school completers respectively, with T_p and T_s being the respective taxes paid on these earnings, and let C_I and C_G be the direct costs paid by the individual and for the individual by the government, (i.e. a subsidy), respectively. Assuming that secondary schooling is not compulsory, that it takes place between the ages of 13 to 17 and that people work until they are 60, the private IRR equation for secondary school education may be written as,

$$\sum_{t=1}^{n=5} \frac{(C_I)_t + (W_p)_t}{(1+r)^t} = \sum_{t=6}^{n=43} \frac{(W_s)_t - (W_p)_t}{(1+r)^t}$$

, and the social IRR as

$$\sum_{t=1}^{n=5} \frac{(C_I + C_G)_t + (W_p + T_p)_t}{(1 + r)^t} = \sum_{t=6}^{n=43} \frac{(W_s + T_s)_t - (W_p + T_p)_t}{(1 + r)^t}.$$

The private IRR is used extensively in human capital theory to explain the individuals life cycle of earnings patterns - the presumption being that investment and not consumption motivations underlie individual decision making in respect of the acquiring and financing of education (see Chapter 2, section III.i.1). The main attribute of the social IRR lies in its potential to be a useful criterion in guiding public education planning. Both rates of return are normally numerically determined by the use of an iterative computer programme.

Rates of return of the above nature are usually called marginal or incremental rates of return on education, i.e. they are rates per level of education. Another more general rate is the average or base line rate of return, where no distinction by level of schooling is made. Most rates calculated are marginal as these are more helpful in guiding decision making in respect of specific educational considerations, but as will be argued later, because of the difficulty of excluding the effects of on-the-job training in earnings, especially using a CBA approach, almost all IRR are 'average rates', in a sense.

The actual data required for the above calculations does sometimes give rise to computational difficulties. Detailed information of sufficient population size on age-earnings profiles per education level is not always readily available. There may be a very limited number of earnings observations arising in each age-education (level or type) 'cell' on which the median or mean earnings are calculated. This often gives rise to "saw tooth"[58] patterns in the age-earnings profiles per

education level which runs contrary to the general patterns in these profiles which seem to have emerged internationally (see Chapter 2, section II. i), and can substantially affect IRR calculations if the "saw tooth" patterns occur in the initial earnings years, which have greater impact in determining the 'discount rate'. For this reason the age-earnings profiles per education level are sometimes smoothed out by,

(a) fitting to the data a function of the expected parabolic form, i.e.

$$\text{Earnings} = a + b\,\text{Age}_i + C\,\text{Age}_i^2$$

, where a,b and c are constants and i indicates the educational sub-group, and (b), using the right hand side formulation to 'determine' earnings per given age per given educational subgroup (which are then used in the IRR equations above).[59]

(V.2) ADJUSTMENTS TO THE IRR EQUATION[60]

(a) Earnings are not only a function of education and age; ability and socioeconomic differences also may account for some of variations in earnings. To standardize earnings for these effects, the gross earnings variation per age - education cohort is sometimes reduced by what is often called the alpha factor (which we represent below by A_1). A more extreme stance in respect of this adjustment would be that earnings, education, ability and socio-economic factors are so closely interrelated that even to attempt to account for the affect of the latter two on earnings by this constant would be farcical.

(b) Lifetime earnings profiles assume each individual will survive to enjoy the earnings associated with each age, but as not all people do survive until, say 60, it is reasonable to make a downward adjustment to earnings (and costs if relevant) by the probability of survival. (Let this factor be

represented below by A_2.)

(c) Not all individuals receiving education are employed and <u>if</u> the sample population does not permit the inclusion of the unemployed educated in its data, then a downward adjustment to earnings may be called for on the basis of the probability of unemployment. (Let this factor be represented by A_3.)

(d) A similar effect arises if individuals receive education but do not choose to participate in the labour market - a reason why women are often excluded in CBA attempts to calculate returns to education. By similar reasoning to (c) one may motivate a downward adjustment to earnings on the basis of the probability of labour participation. (Let this factor be represented by A_4 below.)

(e) Most countries expect some economic growth over the future with the result that earnings could be anticipated to grow aswell (at the same rate). But as cross-sectional data does not reflect this, some upward adjustment to earnings at the expected rate $(1 + g_Y)^t$, where g_Y is the growth in real per capita earnings, would seem reasonable.

(f) Failure and dropout are significant in most education courses. These individuals experience the expense and a certain benefit of education but are not 'credited' with either of these in the cross-sectional data. This can give rise to error effects - the cost per unit education is understated to the extent that the unsuccessful are included in determining the per unit costs, and any increase in earnings due to the education which failures or droupouts were exposed to, inflates the base line educational cohort earnings,thus erroneously reducing the earnings difference due to the incremental education. But, by excluding the latter type individuals from one's base line earnings data (i.e. treating them as a separate group) and by

increasing per unit direct costs by a wastage factor (determined from failers and dropouts) these effects may be countered. Let the cost correction for this wastage be represented by the factor $(1 + f)$, where

$$f = \frac{\text{number dropouts and failures}}{\text{number who attended the course}} .$$

(g) Foregone earnings may be in excess of what was really foregone if there is considerable part time work available. This being the case, it seems reasonable to reduce the foregone earnings cost by the potential for part time earnings. We could represent this effect by say A_5, where A_5 is the downward adjustment to foregone earnings to account for part time earnings.

(h) Timing assumptions (eg. date of entry into the labour market), externalities, consumption effects and risk all may suggest the need for further adjustments, i.e. the above list is not exhaustive.

Considering adjustments (a) - (g) the social IRR equation for secondary school education could look as complicated as this-

$$\sum_{t=1}^{n=5} \frac{(C_I + C_G)_t \ (1 + f)_t + A_2 \ A_3 \ A_4 \ A_5 \ (W_p + T_p)_t \ (1 + g_Y)^t}{(1 + r)^t}$$

$$= A_1 \ A_2 \ A_3 \ A_4 \sum_{t=6}^{n=43} \frac{(W_s + T_s)_t - (W_p + T_p)_t \ (1 + g_Y)^t,}{(1 + r)^t}$$

, where A_1; A_2; A_3; A_4; A_5; f and g_y are all less than one but greater than zero.

However, the fact that (a) - (g) appear to be 'legitimate' adjustments has not been sufficient to result their general usage. The additional data requirements may in many cases have been prohibitive, but more generally it would appear that researchers realise that the rate of return is just an approximation, that precision is really unattainable and that attempts at it are a little futile.

What seems to be more important is the indication of trends and the approximate relation between the returns on various projects, and to do this the assumption of the relative smallness and constancy of the causes for adjustments, is sufficient. This assumption is highly recommended by authorities in rate-of-return analysis such as Psacharopoulos.[61] One possible exception is the alpha factor, (A_1 in our case), in that it may be of slightly greater impact that the other factors (see Chapter 2 section III ii).

(V.3) THE IRR BY STATISTICAL ESTIMATION OF EARNINGS FUNCTIONS

In Chapter 2, section (II.ii. 3) an earnings function of the type,

$$\log Y_j = \log E_o + r_s S + r_{ps} \sum_{t=1}^{j-1} f_t + \log (1-f_j) \quad \ldots \quad (2.19)$$

is derived, where Y_j is earnings, E_o is initial earnings capacity, S is years of schooling, r_s is the rate of return to schooling, r_{ps} is the rate of return to on-the-job training and f is the fraction of time which person j devotes to improving his earning power through investment in education. Demonstration that the coefficient of the S variable is indeed the rate of return to schooling is left until Chapter 2, section (II,ii.3).

A problem which is linked to this earnings function specification, is that it does not permit rates of return by level of education to be calculated. One way of overcoming this problem, is to merely extend the right hand side of equation 2.19 to include the variable S^2. i.e.

$$\log Y_j = \log E_o + b_1 S + b_2 S^2 \quad \ldots \quad (2.19a)$$

, where the last two terms on the right hand side of equation 2.19 are ommitted because they are not relevant to the discussion and b_1 and b_2 are regression coefficients. Treating S as a continuous

variable, $\frac{\partial \log Y_j}{\partial S}$ can be defined as r_s, which gives

$$r_s = b_1 + 2b_2 S \ldots\ldots \qquad (2.19b)$$

, from which the rate of return per level of schooling is readily determinable by substituting the relevant years schooling in equation 2.19b.

A much more popular way of overcoming the problem referred to, is by the use of dummy variables, S_p, S_s and S_h, as shown below.

$$\text{Log } Y_j = \log E_o + b_1 S_p + b_2 S_s + b_3 S_h \ldots\ldots \qquad (2.19c)$$

Here S_p is associated with the number of years primary schooling, say 0-7, S_s is associated with the number of years schooling at the secondary level, say 8-12, and S_h is associated with number of years schooling at the higher education level, say 13-above. Once again the latter two terms in equation 2.19 are ommitted and b_1, b_2 and b_3 are regression coefficients. Using the Mincerian[62] derivation of the primative human capital returns-to-investment function, it follows fairly readily that r_s per level of education is determined by

$$\frac{\triangle \log Y_j}{\triangle S} \qquad \text{(see equation 2.11a).}$$

Just as in the case of the CBA estimations of rates of return to education, adjustments may be made to the earnings function specification such that the rates of return estimated are altered. Chiswick[63], for example, has proposed that the Mincerian earnings function described by equation 2.19, be expanded to include a term which explains that part of earnings brought about through entrepreneurial abilities where a large proportion of the labour force is self-employed, as is often the case in less developed countries. He feels that many studies ignore this group due to the problems of data

collection on them, but that this causes the opportunity cost of education to be understated (and hence the rate of return on education to be overstated) because the self-employed possess greater labour and enterprising abilities than their wage earning counterparts. He proposes therefore, that where self-employment accounts for a substantial proportion of the labour force that, (a) they should be included in the sample population of the study and (b) a term should be added to the Mincerian earnings function which would explain the earnings variation brought about through the entrepreneurial inputs of the self employed. The nature of this term is indicated below, $c\ P_j$ in equation 2.19e.

Defining all earnings as Y_{Aj}, P_j and $(1-P_j)$ as those fractions of these earnings derived from self employment and wage employment respectively, and e and (1-e) as those fractions of earnings derived from <u>self employment</u> due to labour inputs and entrepreneurial inputs respectively, we have,

$$Y_{Aj} = (1-P_j)\ Y_{Aj} + P_j\ Y_{Aj} \qquad ,0 \leq P_j \leq 1$$

and

$$\begin{aligned} Y_{Aj} &= ((1-P_j)\ Y_{Aj} + e\ P_j\ Y_{Aj}) + (1-e)P_j\ Y_{Aj}; \quad 0 \leq e \leq 1, \\ &= Y_j + (1-e)P_j\ Y_{Aj} \\ &= \frac{1}{1-(1-e)P_j}\ Y_j \end{aligned}$$

$$\text{,or } \log Y_{Aj} = \log Y_j + \log \frac{1}{1-(1-e)P_j} \qquad \ldots (2.19d)$$

, where Y_j is the earnings estimated in the Mincerian earnings function.

The term Chiswick proposes to expand the Mincerian

earnings function by is therefore $\log \frac{1}{1-(1-e)P_j}$, which in equation 2.19 (ignoring the last two terms), he describes by coefficient c and dummy variable P_j, i.e.

$$\log Y_j = \log E_o + r_s S + c P_j \qquad (2.19e)$$

, where $c = \frac{\log 1/(1-(1-e)P_j)}{P_j}$ and $P_j = 0$ for the wage-earning person and $P_j = 1$ for the self-employed person.

The interpretation given to c relates to $P_j = 1$, which implies $c = -\log e$, and the expectation is that by the inclusion of term $c P_j$ that r_s would decline.

It should be clear that rate-of-return to education calculations may be readily based on the earnings functions from the discussion in this section and reference to Mincer's analysis. The approach is not however without limitations. Perhaps the greatest of these is that the earnings function approach to rate-of-return estimation does not accommodate direct costs of education in its calculations. As a result of this for the case of social rate of return estimation, where this factor may be significant, the approach is not entirely satisfactory and CBA would appear to have the advantage.

(III) EVALUATION

In its ideal form public project appraisal demands the impossible - it requires that all relevant costs and benefits attributable to a project be specified, weighed against each other on a basis which would enjoy consensus support from society, exactly reflect relevant scarcities, responsibly weight the interest on future generations and demonstrate perfect foresight. The aim of CBA is not to achieve this end - some sort of "all inclusive" decision matrix which incorporates all the non-quantifiable

considerations would be more appropriate for this purpose. CBA is a technique for appraising the quantifiable aspects of public projects which necessarily involves value judgements and operates with uncertainties.

The pessimist may well argue that this amounts to very little but surely the usefulness of CBA varies from project to project. Some projects may lend themselves more to quantification than others and furthermore different authors may reach different conclusions about the same type of public expenditure. The most common treatment of the non-quantifiable elements of public expenditure on education is to incorporate a statement of their expected significance (impact) in the text of the CBA thereby demonstrating an awareness of their existance. Unfortunately one is still left doubting whether this is really satisfactory. The ommission of the non-quantifiable elements of education from the calculus of CBA casts serious doubt over just how reliable the conclusions from the analysis are in establishing a social ranking of economic alternatives which reflect individual preferences and scarcities - a primary purpose of the project appraisal. It seems worth asking then, whether there are any acceptable alternatives to project appraisal as outlined, which yield a preferable social ranking of economic alternatives? What of the ballot box, political lobbying and or greater reliance on the market mechanism?[64] Arrow[65] has demonstrated that voting does not necessarily yield a conclusive result, even if it was a viable alternative, which it is not. A referendum or election cannot be called for every public economic decision. Nor do single votes reflect preference intensities. Furthermore, they are usually made on the basis of general policies rather than particular questions.

The weaknesses of the alternatives to project appraisal do not justify CBA on their own, however. De Wet[66] in an evaluation of CBA points out that it necessarily involves value judgements and believes the introduction of this normative element into the analysis to be severely damaging. His assertion is in

principle valid, for even if no explicit account is made of the distribution of income this implicitly amounts to an acceptance of the existing distribution of income. Certainly interpersonal utility comparisons are inevitable consequences of a cardinal utility justification of CBA and unfortunately an ordinal utility approach using compensation criteria does not provide an acceptable alternative. As, for example, De Wet has argued, compensation is never paid to the losers and in any case, an indeterminate result is produced in the event of intransitive utility curves occuring (the Scitovsky paradox). The great weakness of De Wet's analysis was that he failed to consider the possibility that interpersonal utility comparisons may in fact be socially desirable. Therefore, rather than this being a serious defect inherent in CBA, it may offer the potential for being an outstanding attribute in that distributional criteria may easily and explicitly be incorporated into the analysis. (It is however, acknowledged that the aforegoing argument in no way diminishes the constraining effect non-quantifiable elements have on the CBA outcomes of a particular public expenditure.)

Notwithstanding the possible social virtues of incorporating distributional criteria, a position taken up by Mishan[67] is that it remains of doubtful value. His objection is not with the hypothesis of diminishing marginal utility to increasing income, but with the deductions made on the basis of this hypothesis. If an ordinal framework is adopted for analytical purposes it can be shown[68] that distributional weighting does not remove the reversals 'problem' (or perhaps 'possibility' is a better word) which besets the compensation criterion basis for the social ranking of projects. If, on the other hand, a cardinal approach is followed, the 'crux' becomes the measurement of a marginal utility of income function. This necessarily involves abitrariness as there is no general agreement, or is there ever likely to be, on a unique relationship between 'utils' (i.e. a supposed measure of utility) and commodities (including money).

If, as it seems then, in order to achieve the socially desireable end of incorporating distributional weighting into CBA, we have to retreat to arbitrary assessment, the logical question which follows is who should make this assessment? Should it be the economist based on his expert knowledge of relationships within the economy, or, is this in fact beyond his domain? Sugden and Williams[69] say it is beyond his domain - they argue that he is the 'analyst' not the normative assessor for society. Where value judgements are involved,his function is not to make them but to identify, through the activities of the government, what societies preferences are and to base his weighting measures on this assessment. Their rationale is really quite simple, and on the face of it quite appealing - the economist's 'right' concern is stated to be with the purely technical manipulation of given data to produce consistent decisions,and the government's 'right' concern is determining public policy (a function the electorate would assuredly expect their political representatives to perform) and thus also, the public policy parameters, such as distributional weights and the social discount rate. Part of the economists role, given this scenario, would be to interpret for analytical purposes, the dimensions of these political parameters from the government activities. Sugden and Williams[70] suggest three possible guiding avenues for such investigation - the precedent set by past government actions in investment, the use of marginal rates of income tax based on the belief that their determination involved the principle of equalising the share of real burden of any incremental tax accross all income groups and, most obviously, direct liason with the relevant policy makers. Mishan[71] has also come out very strongly against the use of politically determined parameters. He does not believe that there can be any stability in their setting with continual short term variance being induced by political vogue and the exigencies of state and he is doubtful as to whether it would, in this case, be a mechanism for the redistribution of national wealth. He contends that it is possible that a politically determined CBA could be used to "legitimise" maintenance of the status quo or even enhance the position of the rich. Such a consequence could result from the presence of powerful 'elite', lobbying representation in

government. In short, he does not believe such a system does the economist's or CBA's reputation any good and that in particular, it erodes the credentials of the economist with respect to his ability to provide a valuable independent contribution to project evaluation. The economist's role becomes -

> "as the creature of bureaucracy, or the agent of political opinion entrusted with the task of translating its current prejudices into respectable looking numerals - it is far removed from his traditional role as an independent specialist drawing his inspiration wholly from economic principles of valuation."[72]

Mishan's view is however, extreme and fails to reject the 'core' issue, that is, who other than the government 'should' decide on public policy?

Another issue which has aroused considerable controversy is that of the pricing techniques used in CBA. For example, De Wet, basing his argument on the theory of second best, had this to say:

> "We actually face quite a disheartening situation, the very need for cost - benefit analysis, namely market failure, renders the correct pricing rule to be used unascertainable"[73]

It is a theorem of economics that given perfect competition and and absence of externalities that a competitive equilibrium can be a welfare optimum where wealth is suitabley distributed. But where some of the conditions for a competitive equilibrium are not met, then the pricing rule becomes more complex. It is not as one would expect, that all changes in the direction of perfect competition necessarily bring the economy closer to a welfare optimum. To illustrate this consider an economy where three substitute goods X, Y and Z are produced but where goods Y and Z deviate from their marginal costs by 10 and 20 percent respectively, although both are produced at optimal levels. The problem is, given this state of affairs, how is "new good" X to be priced such that an optimal output of X,Y and Z is produced? Optimality under perfect competition may be obtained where the ratios of marginal costs equal the ratio of prices, but given

the deviations from marginal costs, as above, the correct pricing rule for good seems, indeed, "unascertainable." The price at which X should be valued appears to be between 10 to 20 percent over its marginal cost if optimality is to be approached. If the price of good X was set equal to its marginal cost of production, this would involve a greater departure from the ideal position of equal price-marginal cost ratios.

Mishan[74] feels that the impact on the rest of the economy of the single project is however, not sufficient to fear making things worse by pricing commodities at their marginal costs. Little and Mirrlees[75] justify their approach on an efficiency proposition. They contend that if public production is inefficient, this implies that a change in plans makes it possible to have more of some goods without having less of others. Given then, the not very demanding condition, that the government could distribute the 'surplus' in such a way as to give rise to an unambiguous improvement in welfare, it appears that valuation by their numéraire does not give rise to ambiguous welfare results, as implied by the second best theorem line of attack. Graaff[76] on the subject of the Little-Mirrlees approach, does not accept that their approach offers a solution to domestic market distortions because international prices are also subject to distortion, eg. by cartel formation and surplus output dumping. The weakness of this criticism lies in its failure to appreciate the flexibility of the Little-Mirrlees approach in accounting for such distortions.

Out of an evaluation of CBA on the basis of second best theory, one can identify two opposing points of view. One could reach the

> "paralzing conclusion that unless all optimal rules are everywhere met nothing at all may be said"[77]

as do De Wet and Graaff, or one could take up the position that the economy is mainly inclined toward the Pareto optimum (i.e. the exchange optimum,

$$\frac{\partial U_1}{\partial X_1} \Big/ P_1 = \frac{\partial U_2}{\partial X_2} \Big/ P_2$$

the production optimum, $\frac{\partial X_1}{\partial N_1} / W_1 = \frac{\partial X_2}{\partial N_2} / W_2$ and the

top level optimum, $\frac{\partial U_1}{\partial X_1} / \frac{\partial U_2}{\partial X_2} = \frac{\partial X_2}{\partial N_1} / \frac{\partial X_2}{\partial N_2} = \frac{P_1}{P_2} = \frac{W_1}{W_2}$,

where U = utility X = a goods, N = a factor, P = price of a good and W = price of a factor), and thus that it should not be too far removed from such position for any length of time so as to prevent reliable quantitative conclusions where 'isolateable' deviations from the Pareto optimums occur, as does Mishan.[78] The danger of the former approach is, as Frisch points out, that -

> "As long as economic theory still works on a purely qualitative basis without attempting to measure the numerical importance of the various factors, practically any conclusion can be drawn and defended."[79]

This is not the same, of course, as prescribing that the discipline of economic science should have as its objective, the attainment of quantitative precision. Pigou has already warned us that the very nature of economic study prohibits anything other than tentative conclusions -

> "This malleability in the actual substance with which economic study deals means that the goal sought is itself perpetually shifting, so that even if it were possible by some experiment exactly to determine the values of economic constants today, we could not say with any confidence that this determination would hold good also of tomorrow."[80]

- an observation which leads us to the issue discussed in the paragraph below.

A contentious issue which is not limited in its focus to CBA but which is nevertheless very applicable to CBA, especially applied to education, is the matter of uncertainty. In a world which is changing at an ever increasing rate[81] and there is less and less certainty about future trends concerning all aspects of

society, it becomes questionable how cost-benefit analysts can project past and present indications ten to forty years into the future. If forecasting five years ahead is proving to be very inaccurate, it suggests that forecasts longer than this are bordering on the rediculous. Yet, although CBA applied to education does not do this explicitly, (as does manpower planning), it is assuredly implicit in the analysis. The first observation which can be made in this respect is that a CBA rate of return to education is an impure ex post measure - it is the rate of return one could expect to get on investment in education only if cross-sectional earnings patterns remain unchanged. As society changes so this rate will change mirroring the changing scarcities in society, and there-in lies the great virtue of CBA - the IRR is not the return society will get on its educational investment, it is a barometer which can continually be used as a guideline to scarcities for education planning purposes. The second observation which can be made is an empirical one - how inaccurate an inconsistant have the rates of return calculated thus far been over time and across countries of differing development. Psacharopoulos[82] in a comprehensive international comparison found considerable consistancies in rate of return patterns, especially in so far as the prime importance of basic education was concerned. A sensible explanation for this lies in the adaptability of educated labour to the continually changing demands of society. This would imply that in spite of the rapidly changing nature of society, perhaps more faith than one is tempted to place on first appearances on the rates of return to education, is justified.

Clearly CBA has severe limitations and it is only one consideration in a wide range of other economic, social and political influences which must necessarily be borne in mind by the decision maker. Nevertheless it remains an important consideration for the decision maker. It not only serves to bring all relevant costs and benefits of a project to the notice of the decision maker (which some claim is all its achieves, eg. Graaff),[83] it also serves as an indicator the relative economic

worth of projects[84], even if this is within a context of underlying value judgements, uncertainty and a margin of imprecision in the pricing of factors and commodities. The technique is least applicable to projects which contain predominantly non-quantifiable elements and or, are large relative to the economy and as such are expected to have a widespread economic impact. CBA is a partial analysis and is not suited to such situations. A general equilibrium analysis may be recommended in such a case.[85] It would seem reasonable to conclude then, that CBA does constitute a useful analytical technique for guiding decision making in many areas of public expenditure, education being one of them, but that every effort has to be made by the analyst to bring the subjectivity, uncertainty and imprecision necessarily inherent in the results, aswell as the ommitted non-quantifiable elements of the expenditure, to the attention of the decision maker.

(IV) REFERENCES

1. Prest, A.R. and Turvey, R. "Cost-Benefit analysis: A survey", Economic Journal, Volume 75, December, 1965, p. 683-735.

2. Dupuit, J. "On the measurment of utility of public works", International Economic Papers, Volume 2, 1844. (Translated from French.)

3. Schultz, T.W. "Investment in human capital", American Economic Review, Volume 51, 1961, p. 1-17.

4. Psacharopoulos, G. Returns to Education: An international comparison. Amsterdam, Elsener, 1973.

5. Blaug, M. An introduction to the economics of education. London, Penguin, 1972, Chapter 9.

6. Pigou, A.C. The economics of welfare, (Fourth Edition). London, Mac Millan, 1960, Part II, Chapter II, p. 134-5.

7. Pigou, A.C. ibid.

8. Pigou, A.C. ibid.

9. Viner, J. "Cost Curves and supply curves", Zeit National-okonomie, Volume 3, September, 1931, p. 23-46. In Viner's paper these concepts were introduced. (Mishan, E.J. Economic efficiency and social welfare. London, Allen and Unwin, 1981, p. 135.)

10. Prest, A.R. and Turvey, R. op.cit., p. 689-690.

11. Pearce, D.W. and Nash, C.A. The social appraisal of projects. A text in cost-benefit analysis. London, Mac Millan, 1981, p. 89.

12. Hicks, J.R. "Consumers' surplus and index-numbers", Review of Economic Studies, Volume 9-10, 1941-1943, p. 126-137.

13. Hicks, J.R. ibid.

14. Pearce, D.W. and Nash, C.A. op.cit., p. 94.

15. Pearce, D.W. and Nash, C.A. op.cit., p. 97.

16. Pearce, D.W. and Nash, C.A. op.cit., p. 110.

17. Little, I.M.D. and Mirrlees, J.A. Project appraisal and planning for developing countries. London, Heinemann Educational Books, 1974.

18. Little, I.M.D. and Mirrlees, J.A. op.cit., p. 68.

19. Little, I.M.D. and Mirrlees, J.A. op.cit., Chapter 12.

20. Little, I.M.D. and Mirrlees, J.A. op.cit., p. 112.

21. Little, I.M.D. and Mirrlees, J.A. ibid.

22. FitzGerald, E.V.K. Public sector investment planning for developing countries. London, MacMillan, 1978, Chapter 5.

23. Little, I.M.D. and Mirrlees, J.A. op.cit., p. 169-170.

24. FitzGerald, E.V.K. ibid.

25. Little, I.M.D. and Mirrlees, J.A. op.cit., p. 145.

26. Little, I.M.D. and Mirrlees, J.A. op.cit., p. 272.

27. Little, I.M.D. and Mirrlees, J.A. op.cit., p. 229.

28. Pearce, D.W. and Nash, C.A. op.cit., p. 121.

29. Pearce, D.W. and Nash, C.A. op.cit., p. 123.

30. Pearce, D.W. and Nash, C.A. op.cit., p. 124.

31. Blaug, M. op.cit., p. 106.

32. Pearce, D.W. and Nash, C.A. op.cit., p. 139.

33. Blaug, M. op.cit., p. 108.

34. Psacharopoulos, G. op.cit., p. 31-32.

35. Pearce, D.W. and Nash, C.A. op.cit., p. 27.

36. FitzGerald, E.V.K. op.cit., Chapter 6.

37. Squire, L. and Van der Tak, H.Q. Economic analysis of projects, IBRD. Baltimore, John Hopkins, 1975, p. 103.

38. Kaldor, N. "Welfare comparisons of economics and interpersonal comparisons of utility", Economic Journal, Volume 49, September, 1939, p. 549-552.

39. Scitovsky, T. "A note on welfare propositions in economics", Review of Economic Studies, Volume 9, 1941, p. 77-88.

40. Little, I.M.D. A critique of welfare economics, (Second Edition). London, Oxford University Press, 1957, p. 101.

41. Mishan, E.J. Economic efficiency and social welfare. London, Allen and Unwin, 1981, p. 33-44.

42. Mishan, E.J. ibid.

43. Mishan, E.J. op.cit., p. 40.

44. FitzGerald, E.V.K. op.cit., Chapter 6.

45. Arrow, K. and Lind, R.C. "Uncertainty and the evaluation of public investment decisions", American Economic Review, Volume 60, June, 1970, p. 364-378.

46. Fisher, A.C. "Environmental externalities and the Arrow-Lind theorem", American Economic Review, Volume 63, September, 1973, p. 722-725.

47. Arrow, K. and Lind, R.C. ibid.

48. Fisher, A.C. ibid.

49. Pearce, D.W. and Nash, C.A. op.cit., p. 83-88.

50. Keynes, J.M. The general theory of employment, interest and money. London, MacMillan, 1957, p. 135.

51. Mishan, E.J. op.cit., p. 193.

52. Pearce, D.W. and Nash, C.A. op.cit., p. 159-164.

53. Marglin, S. Public investment criteria. London, Allen and Unwin, 1967, p. 59.

54. Becker, G.S. "Optimal investment in human capital". Investment in human capital, (Edited by Kiker, B.F.). Columbia, University of South Carolina Press, 1971, p. 2-12.

55. Musgrave, R.A. The theory of public finance. Tokyo, McGraw Hill, 1959, p. 51.

56. Pigou, A.C. op.cit. p. 24-30.

57. Mishan, E.J. "A proposal normalisation procedure for public investment criteria", Economic Journal, Volume 77, December, 1967, p. 777-796.

58. Psacharopoulos, G. "Returns to education: An updated international comparison", Education and Income, World Bank Staff Working Paper, July, 1980, p. 78.

59. Psacharopoulos, G. ibid.

60. Psacharopoulos, G. Returns to education: An international comparison. Amsterdam, Elsevier, 1973, Chapter 2.

61. Psacharopoulos, G. ibid.

62. Mincer, J. Schooling, experience and earnings. New York, National Bureau of Economic Research, 1974.

63. Chiswick, C.V. "On estimating earnings functions for LDC's", Journal of Development Economics, Volume 3, 1976, p. 67-78.

64. Graaff, J de V. "Cost-Benefit analysis: A critical view", South African Journal of Economics, Volume 43, Number 2, June 1975, p. 233-244.

65. Arrow, K.J. Social choice and individual values, (Second Edition). New York, Wiley, 1951, p. 59-60.

66. De Wet, G.L. "The state of cost benefit analysis in economic theory", South African Journal of Economics, Volume 44, Number 1, March, 1976, p. 50-64.

67. Mishan, E.J. Economic efficiency and social welfare. London, Allen and Unwin, 1981, Chapter 15, p. 165-173.

68. Mishan, E.J. ibid.

69. Sugden, R. and Williams, A. The principles of practical cost-benefit analysis. Oxford, Oxford University Press, 1978, p.

70. Sugden, R. and Williams, A. op.cit., p.

71. Mishan, E.J. op.cit., Chapter 16, p. 174-187.

72. Mishan, E.J. op.cit., p. 162.

73. De Wet, G.L. op.cit., p. 55.

74. Mishan, E.J. Cost-benefit analysis: An informal introduction. London, Allen and Unwin, 1971, p. 90-100.

75. Little, I.M.D. and Mirrlees, J.A. op.cit., Chapter 19, p. 367-373.

76. Graaff J. de V. op.cit., p. 242.

77. Mishan, E.J. Economic efficiency and social welfare. London, Allen and Unwin, 1981, p. 19.

78. Mishan, E.J. op.cit., p. 19.

79. Frisch, R. "From Utopian theory to practical applications: The case of econometrics", Re impression De Les Prix Nobel en 1969, Nobel Memorial Lecture, Stockholm, Nobel Foundation, 1970.

80. Pigou, A.C. op.cit., p. 10.

81. Toffler, A. Future shock. London, Bodley Head, 1970.

82. Psacharopoulos, G. op.cit.

83. Graaff, J. de V. op.cit.

84. Hicks, J.R. In a comment following De Wet, op.cit., p. 63-64.

85. Prest, A.R. and Turvey, R. op.cit., p. 685.

CHAPTER 2

THE HUMAN CAPITAL BACKROUND TO THE USE OF COST BENEFIT ANALYSIS IN EDUCATION

(I) AN HISTORICAL PERSPECTIVE

It was indicated in the previous chapter that the application of CBA to the field of human capital investment and more specifically to investment in education was a relatively recent development, that is, a development of the last twenty-five years or so. Interest in the knowledge and skills embodied in labour actually dates back much further than this. Authors such as Adam Smith, Irving Fisher and Alfred Marshall all made early contributions in this field. In this section we look at some of these early contributions, at the contention that the topic became neglected after Marshall's treatment of human capital until contemporary authors such as Theodore Schultz re-awakened interest in the field, and finally, at what exactly motivated this renewed interest.

Smith compared the acquisition of skills to investment in machines in a section of "The wealth of Nations" where he sought to explain the source of differences in the wages of skilled and unskilled labour. His contribution is important in that he captures the essence of what underlies the approach taken in the recent awakening of interest in human capital:

"When any expensive machine is erected, the extraordinary work to be performed by it before it is worn out, it must be expected, will replace the capital laid out upon it, with at least the ordinary profits. A man educated at the expense of much labour and time to any of those employments which require extraordinary dexterity and skill, may be compared to one of those expensive machines. The work which he learns to perform, it must be expected, over and above the usual wages of common labour, will replace him the whole expense of his education, with at least ordinary profits of an equally valuable capital. It must do this too in a reasonable time, regard being had to the very uncertain

duration of human life, in the same manner as to the more certain duration of the machine."[1]

The implication of this is that human capital, rather than being a "metaphor without meaning",[2] is functionally analogous to physical capital. It follows that capital budgeting techniques are equally applicable to expenditures on human capital.

Following this theme it is easy to see the sense in Fisher's[3] definition of capital as being inclusive of the skill and knowledge resources embodied in labour. Fisher provides a very general definition of the term capital in that he includes in it any stock of assets which exists at a given instant and yields a stream of services over time. Educational 'investment' would fit this broad definition in so far as it could be argued that the stock of skills and knowledge embodied in labour would cause labour to increase it's productivity over time - a proposition which is intuitively acceptable and follows directly from the common under standing of the term 'skilled' labour.

A corrollary to this proposition, in an efficient economy where wages reflect higher productivity, is that skilled labour will earn higher wages than unskilled labour - which is important because it constitutes a basic premise underlying the application of CBA in education.

One observation which has given rise to serious doubts on the merits of the analogy between the human and physical capital concerns the tradability of human capital. One could argue that a successful analogy to conventional capital is only obtained if, (a) capital value may be determined by discounting income flows arising from use of the asset and (b) the asset is negotiable on a capital market, where the latter is taken to be a mechanism where past and current income are converted into assets which produce future income. Human capital may be analogous by (a) but it is certainly not analogous by (b).

We no longer live in slave societies where the future services

of people can be bought or sold on a market and although some people tie up their future services for considerable periods, eg. sports and movie stars, this is the exception rather than the rule. The consequence of the non-tradability of human capital is that it has not been incorporated, at a market place level, into what is commonly defined as capital.

It is on this very point which Marshall bases his implicit rejection of the inclusion of knowledge and skills embodied in labour in his definition of capital:[4]

"And if we are seeking a definition that will keep realistic economics in touch with the market place, then careful account needs to be taken of the aggregate volume of those things which are regarded as capital in the market place". [5] He was fully aware of Smith's and Fisher's positions in respect of the likeness to capital of knowledge and skills embodied in labour, but felt that this was valid,

> "only as a broad indication of general tendencies."[6]

He argues that parents have different reasons for educating their children than the pure profit motivation that capitalists have for investing in new machinery. Parent's motivations for their children's education, he suggests, are to provide their children with a better life than their own and the profitability perception which is plausibly inherent in this motivation is discounted as unlikely because of the clouding influence, that the longer time required to invest in education and to reap the returns from this education, has on the parent's perceptions. It is certainly not convincing that these grounds alone are sufficient to reject the human capital analogy suggested by Smith and it becomes less convincing still when Marshall's own use of the analogy is taken into consideration. For example, while commenting on education in the workshop he refers to-

> "the difficulty that whoever may incur the expense of investing capital in developing the abilities of the workman, those abilities will be the property of the workman himself,"[7]

, a theme which Becker[8] follows up in his pioneering contribution in the field of human capital theory. A clear unambiguous view from Marshall writings on the question of the analogy of human to physical capital, therefore fails to emerge.

In spite of this, many commentators attribute the neglect of the theory of human capital over the first half of the Twentieth century to Marshall.

Kiker, for example, had this to say on Marshall:-

> "Although this essay is not exhaustive, it will be shown in essence, that the concept of human capital was somewhat prominent in economic thinking until Marshall discarded the notion as 'unrealistic' "[9]

He endorsed this in a subsequent article[10] concluding that it was the insistance of Marshall and his followers to keep "realistic economics in touch with the language of the market place" which prevented their use of the analytical framework pertaining to capital, for the treatment of improvements in the stock of skills and knowledge embodied in labour.

There have been other explanations for the apparent neglect of the theory of human capital subsequent to Marshall. Bates[11], for example, hypothesises that contemporary vogue accounts for the periodic pre-occupations with the relative, alternating significance of material and human capital.

Bowman's[12] analysis of the "revolution" of economic thought has similarities to this. She recognizes that it was the need for a better explanation of the phenomenon of economic growth (which was fostered by Schultz) that underlay the 'recent' interest in human capital theory, but claims that, like many other theories, it had a historical 'thesis' and 'anti-thesis'.[13] The 'thesis' was the labour theory of value in which men were capital by Fisher's definition. An intervening period ensued where a new thesis emerged where man and his labour were still of importance

but no more so than any of the other factors of production. The 'anti-thesis', she argues,was a product of Keynesianism where the emphasis was shifted,

> "from a viewing labour as a passive agent that would find employment only if there were a high enough rate of 'investment' and, most especially, of investment in the production of physical producer capital." [14]

Finally, the re-emergence of the original 'thesis', by her analysis, was associated with,(a) the rising disillusionment with the singular importance of physical capital in the post-war growth period and (b) the failure of third world development to live up to expectations. It was found that physical capital only "worked wonders" in lands where there were qualified men who knew how to use it.

This brings us to the last item of discussion in this section: what motivated the renewed interest in human capital? Conventional approaches to growth just prior to the renewed interest in human capital emphasised the role of physical capital accumulation in securing steady growth of national output. However, this was not consistent with the empirical experience: eg. Denison[15] (1962) found that two-thirds of America's growth; between 1929 and 1957 could not be explained by a Cobb-Douglas production function, that the elasticity of output with respect to labour was just less than three times the elasticity of output with respect to capital and that almost a quarter of the growth in national income was due to increased education of the labour force.[16] Clearly conventional approaches to explaining the growth of output were inadequate and a massive endorsement to the significance of human capital was implied - a result not unexpected by Schultz. Schultz in a presidential address to the Annual Meeting of the American Economic Association in December 1960, had already stated that,

> "It has been widely observed that increases in national output have been large compared with the increases of land, man-hours and physical reproducible capital. Investment in human capital is probably the major explanation for this difference."17

In the address Schultz not only contended that improvement in human productive capacity was the greatest single contributor to growth in real output and growth in the real earnings of workers, but also that it was the deficiency of the human capital component in the less developed countries which restricts their growth.

To support his assertion Schultz cited the Horvat formulation[18], which stressed the correlation of the absorptive capacity of the economy and the investment in material capital. In this pioneering work Horvat asserts that a search for an optimum rate of investment must involve a balance between expenditure on material capital (termed investment) and expenditures on the human factor of growth (termed the "A-factor"[19]). He referred to the latter as productive expenditures and included in this category, personal consumption, health, knowledge and economic and political organization, i.e. factors which increase the ability of society to produce material goods. The hypothesis[20] suggested that as the economy develops so knowledge becomes the dominant factor determining the rate of increase in the absorptive capacity of the economy (i.e. the dominant A-factor) and hence the key to growth.

To conclude, it can be said, that the economics of education traces its roots back to very early writers in the field of economics as has been indicated. The main concern at that stage was with the significance rather than with the theory of human capital although Smith did suggest that a useful analogy to physical capital existed for analytical purposes. But it was not until Schultz that the economics of education really came to life. (He is widely accredited as having initiated the birth of this discipline.[21]) Since Schultz's pioneering work there has been extensive interest shown in fields such as the contribution of education to economic growth, manpower planning and applications of CEA and CBA to education. Brief consideration is given to the first three topics mentioned, but for most of the rest of this chapter, we consider the human capital <u>background</u> to the use of CBA in education in the light of the more 'recent' theoretical expositions on the topic.

(II) THE HUMAN CAPITAL BACKGROUND TO THE USE OF CBA IN EDUCATION

The discussion of this topic, essentially a part of the discipline of the economics of education, is mainly concerned with the relationship between earnings and education. In a CBA study of education the benefit of education is measured almost totally from earnings variation, and most of the costs, being foregone earnings, also involve this measure. It is against this background that the significance of the theoretical discussion on human capital in this chapter should be seen.

The topic is introduced against the background of the theory of the economics of education - the latter being the broad area of discussion which has grown out of controversy over the relationship between earnings and education. After this, a few highly acclaimed theories on the nature of this relationship are developed. The selectivity is unavoidable as there has been an 'explosion' of literature on this topic over the last twenty-five years, forcing selectively in model presentation. Bowman,[22] in her article, "The human investment revolution in economic thought", commented on the "stunning" wave of interest in the field, which had developed by 1966. Perhaps just as strong an adjective is applicable today.

In an acknowledgement of this fact, following the presentation of the theoretical considerations referred to above, a section entitled, "Returns to Education - the debate continues" is included and, on that open-ended note, the discussion on the human capital background to the use of CBA in education, is concluded. In this case again, some qualification is necessary, in the sense that the object of the discussion is not comprehensiveness, it is merely to highlight the fact that this is not an area in which economists have managed to achieve much consensus. Thus we conclude that our dependence for the use of CBA in education on earnings data to measure the benefits and costs of education, must be qualified by the acknowledgement of the present state of uncertainty over the precise nature of the relationship between education and earnings.

(i) A BRIEF INTRODUCTION AGAINST THE BACKGROUND TO THE ECONOMICS OF EDUCATION

We began this chapter with a comparison between human and physical capital in order to see whether we could apply one analytical framework to both forms of capital. By Fisher's definition, it appeared that we could, although this seemed to require the existence of a slave labour market so that future labour services could be traded in the market place. Taking a Marshallian stance, this was "unrealistic" but nevertheless seemed to offer the potential for some fruitful perspectives. From the point of view of attempting a CBA, the most fruitful perspective turns out to be the treatment of human capital, or more particularily for this analysis, education, as an investment good. In the final analysis this amounts to saying that we choose to ignore the consumption aspects of education. But how valid is this?

No definite answer to this question is possible. From above, we have from Fisher's definition of capital, that if education leads to increased future earnings, then it is capital. On the other hand, by taking a Keynesian view, where a firm's expenditure is generally regarded as investment and a household's expenditure is generally regarded as consumption, education is only an investment if undertaken at the firm's expense. Inevitably, we seem to be led to the conclusion that we are dealing with an 'intermediate' good and that attempts to force it into one or other category, by definition then, will be frustrated.

Nor is an unambiguous answer to the question provided in the individuals motivation for acquiring education or, in a social sense, for the social motivation in promoting the acquisition of education - some people see their education as investment, some as consumption and many as a bit of both. But this is all we need to motivate a CBA application to education - as long as we argue that there does exist an investment motivation for education we have sufficient reason for treating education as an investment good. In the South African context we may motivate this by

reference to page one of the "1981 Report of the Main Committee of the Human Sciences Research Council (HSRC) Investigation into Education"[23], where it is stated that the Cabinet requested the HSRC to research education policy in South Africa with the social objectives of -

(a) allowing for the realization of human potential, (which could be expressed alternatively as maximizing individual human capital acquisition),

(b) promoting economic growth, and

(c) improving the quality of life.

While there is definitely more to these objectives than just social investment, this aspect stands out perhaps, more clearly than the other objectives. This being the case, there seems to be a very sound foundation for the economic study of education as an investment good even though there be a consumption component of education.

The type of data which is most accessible to the researcher is cross-sectional, as good time-series data containing the required earnings and cost details is rare. The cross-sectional data are obtained from a variety of sources - census and national or regional surveys being the most common. The core data required for a CBA application to education is that of age, education and earnings (from work, not full income) per individual. From this data, so-called age-earnings profiles per educational cohort are determined. The pattern of these, which have emerged from various studies, consistently seem to exhibit trends like those drawn in figure 2.1 below.[24]

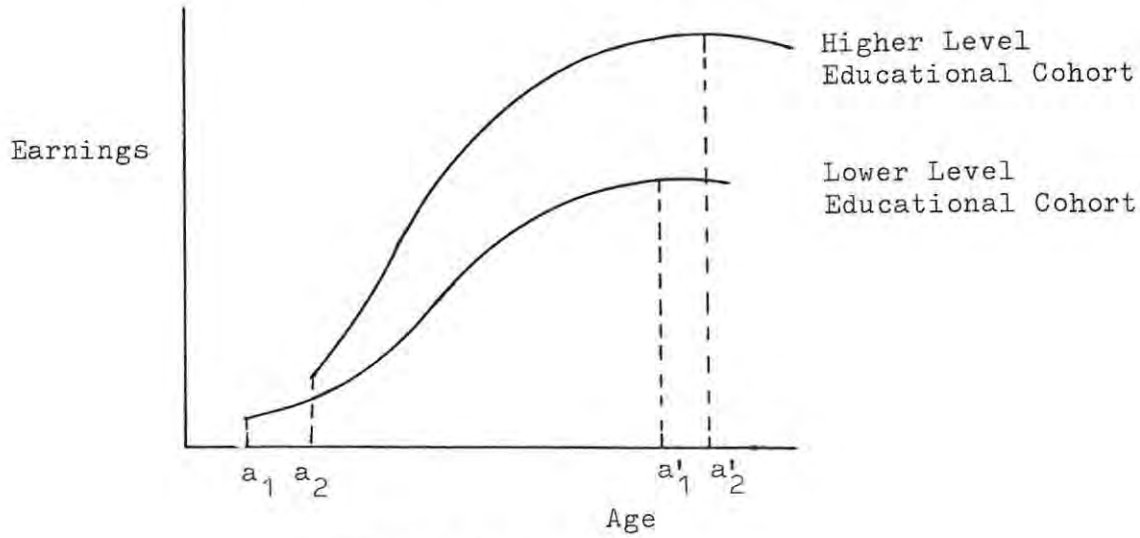


Figure 2.1

Note that the data often only relates to males as it is argued that because females often withdraw, at an early post-education age from the labour market and because there may be discrimination against them in the labour market, that their earnings are not a good proxy for estimating rates of return to education.

Those individuals belonging to the higher educational cohort forego earnings over the age a_1a_2, (which is added to their direct costs to determine the overall cost of their education), but experience a sharper rise in earnings up to their maximum, which also occurs at later age than that experienced by those belonging to a lower level educational cohort (i.e. Oa'_2 is to the right of Oa'_1). All age-earnings profiles seem to exhibit concavity from the age axis over all but the very early working ages.

The task facing economists arising from the above phenomenon has been twofold - that of providing an economic interpretation (or model) for the relationships and secondly, that of presenting the data in a form which could provide more meaningful guidelines to possible users of it. On both issues the challenge was taken up in earnest. Perhaps the most influential explanation for the relationship between education and earnings has been that provided by Becker[25], who, with the aid of some conventional economic analysis, has satisfactorily explained the characteristics found in the various age-earnings profiles. His theory is discussed in more detail along with the contributions of a few others in the remaining part of this chapter - the objective being to achieve greater clarity on the nature of the theoretical relationship between education and earnings.

There are two ways in which the data, as collected in age-earnings per educational cohort form, is transformed into a form meaningful to the user - CBA or regression analysis using human-capital earnings functions. In cognizance of the increasing popularity of the later, some of the theory underlying the human-capital

earnings function approach is integrated into the discussion of human-capital theory in this chapter. Both CBA and regression analysis are capable of producing "rates of return" to education although the term "rate-of-return analysis" seems to be restricted to meaning a CBA approach.

Although from the above discussion, it may seem that we have here, a "progressive" theory with a sound empirical base, the status of human capital theory is not exceedingly high. ("Progressive" is used here in the sense that it is capable of revealing hitherto novel unexpected facts[26].) The problems arise from the inability empirically to establish generally that education does cause higher productivity and therefore higher earnings. A high correlation between education and earnings is far from sufficient for this purpose. Ability, education, social backround and earnings are so interdependent that separating their influences is almost impossible, causing a severe identification problem.

The most often cited of these clouding influences are ability and social backround. A common way in CBA of dealing with this problem has been to use Denision's assumption approach, which in the case of his work, "The Sources of Economic Growth in the United States and the Alternatives Before Us", was that three-fifths of the difference in earnings, after age has been taken into account, were attributable to education alone in the United States.[27] Two other assumption possibilities suggested by Denison were that half or two-thirds of the difference in earnings, after age had been taken into account, were attributable to education alone. As it has turned out, the latter assumption (two-thirds) appears to have enjoyed the most popular support and was substantiated by Becker[28] in a review of five independent studies in his work Human Capital in 1964. Consequently this factor, two-thirds, frequently termed the alpha factor, is that which is often used in CBA studies to reduce earnings differences, after age has been taken into account, so that the difference remaining after deflation by this factor may be taken to reflect the benefit arising from education alone. Denison recognizes however, that his assumption

is made in a time and place context and will not suit all variations of these. In chapter 2, section (III.ii) some further research on the alpha factor is presented.

In view of the problems associated with the interpretation of the high correlation between education and earnings, it comes as no surprise that there have emerged competing theories for explaining the phenomenon. One such theory is that the high return to education may not reflect increased productivity on the part of the educated at all, it may merely reflect the greater power of the educated to effect a redistribution income from the less educated towards themselves. This is described in this chapter as being part of the credentialist approach and is considered in the next section in contrast to the human capital theory approach.

Up until this point we have said very little about those who we expect to use the results obtained from the CBA or why they should need these results. The decision making area at which CBA targets its results, is primarily in the planning of education and in particular at those responsible for this task. Perhaps the focal question of relevance here is simply, is there a need for planning education at all? Alternatively, why not trust laissez-faire to ensure an efficient allocation by the establishment of a competitive equilibrium in the 'education market'?

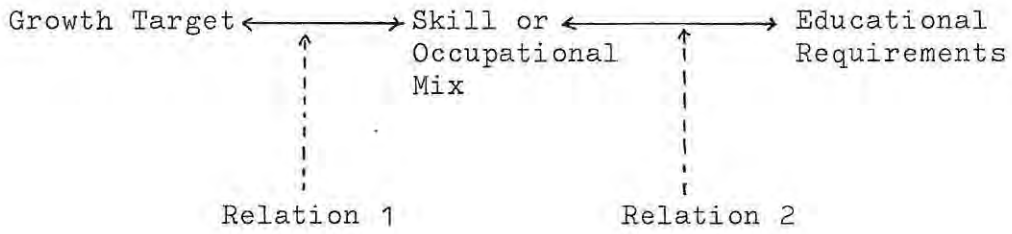
The conditions necessary for a reliance on laissez-faire are, that the consumers must be informed of the supply available and the benefits from acquisition, that there exist no internal economies of scale and that there is an absence or externalities and or publicness in production and consumption.[29] If these conditions are not fulfilled, then a situation of market failure may be established and there arises the possibility of achieving a Paretian improvement through State intervention in the allocation process. There are grounds for believing that none of these conditions is completely fulfilled - certainly there are internal economies in the process of educating and there do seem to be certain external economies arising out of education, eg. passing

the benefit of understanding to those around the educated and the creation of a suitable environment for research. Of course, market failure is only one reason why there may be a case for State participation in the provision of education. One could argue for State intervention purely on the egalitarian grounds that it is a good thing per se, to provide equal education opportunity for all in society. While these considerations are also relevant to the planning of education they are however, beyond the scope of what needs to be considered in this analysis. The presence of market failure in education not only suggests a need for possible State participation, it may also suggest a need for the adjustment of prices for CBA purposes or, if one refuses to accept that the economic benefits of education can be valued, for CEA purposes. The application of CEA to education is a full study in its own right and is not discussed here except to observe perhaps, that CEA does not imply neutrality towards benefits and thereby avoid the problem of measuring benefit altogether. Although no monetary tag is attached to the benefits, some proxy objective measure of attainment and the determination of a weighting system for these 'measures' is required, if it is to be made useful for decision making. As the problem of market price adjustment for CBA purposes was raised in chapter 1, there is no need to elaborate on this point.

This leaves us then, with the issue of analyzing the nature of State participation in education given market failure. One way of doing this is by considering the relevant decision making process in a hierarchical order. For example, one could describe matters such as what the overall budgetry allocation to education should be, as higher order decisions, matters such as how much of this allocation should go towards a particular type of education, as intermediate order decisions and finally, matters such as how much of that allocation should go towards a particular level of education, as lower order decisions. CBA is not extremely well suited to the guidance of higher order decisions because of the impossibility of determining the sources of funds (from private savings or consumption) and the difficulty in determining comparable measures of net benefit from all other State expenditures

eg. security and health. However, there is much more scope for the application of CBA in guiding the intermediate and lower order decisions, and it is reasonable to conclude, that it is at the intermediate and lower order decision tiers that the CBA studies in the field of education are most relevant.

Notwithstanding this, it is a relevance which seems to be largely ignored in South Africa as CBA is not, in fact, currently in any significant use at all in the guidance of educational planning within the framework of overall economic strategy, which in this country's case is described by the Economic Development Programme[30] - manpower planning is the leading technique for accomplishing this end. The rationale underlying the use of manpower planning is based on the long time lags in providing skilled people and the desire to avoid expensive disequilibria, which may arise out of Cobweb cycle tendencies that may develop on the employment market as a result of short-run supply inflexibility. The essentials of a manpower planning model may be depicted as below.



A growth target is set, manpower requirements are forecast on this basis, expressed in terms of some occupational mix and finally, based on what training is necessary to develop the required level of expertise, the educational requirements are determined. The two relations indicated are thus fundamental to the model. Having set a growth target, some technique for determining the occupational mix is required (relation (1)) and having determined the occupational mix required, a technique for translating this into educational requirements is required (relation (2)). To keep these techniques operable, a rigid approach seems necessary in respect of both of these relationships - the substitution possibilities between occupations are ignored

in favour of a more manageable fixed skill input coefficient system with respect to relation (1) and, ignoring the enormous difficulties caused by what activities are defined to fall under a particular occupational category, a fixed educational requirement per occupation assumption is made with respect to relation (2). In addition to this unrealistic rigidity, the manpower requirements approach has very long time horizons and requires considerable data collection - the net result of which, inspires little confidence in the approach. A fundamental problem with the manpower requirements approach is that it is a supply side analysis and the changing nature of demand is not permitted much significance. The error in this is that rational decision making on educational investment must require equal consideration of supply side projections aswell as those of the demand side. Furthermore, on the supply side, the substitution possibilities offered by various types of training should be taken into account. Blaug[31] has suggested the possibility of an integrated forecasting system with built in errors of margin which increase exponentially over time, thereby allowing for uncertainty , for this purpose. By this method,a demand projection is incorporated with a straight manpower requirements approach. His model is depicted graphically below (figure 2.2), and is fairly self explanatory.

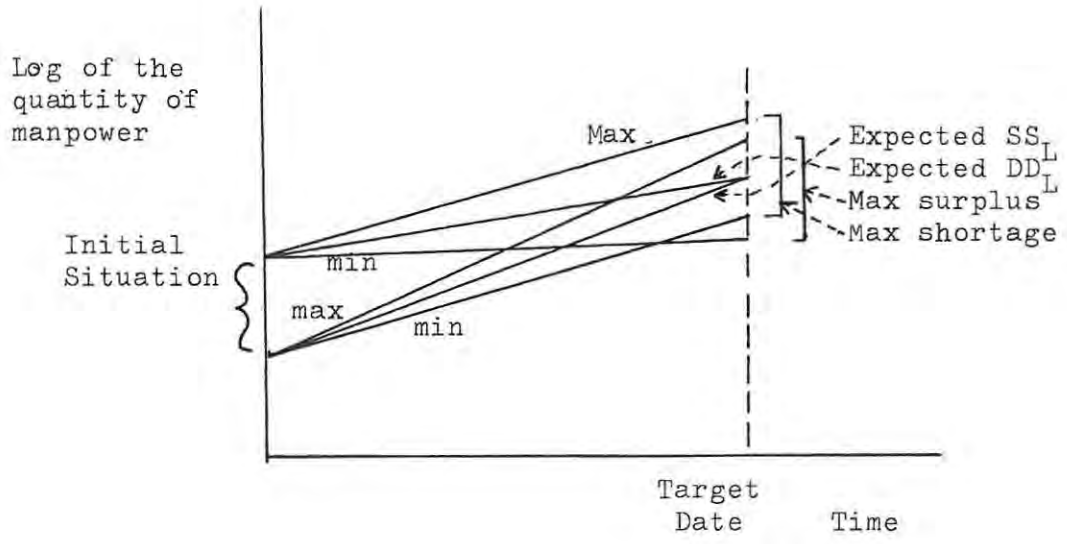


Figure 2.2

In figure 2.2 two types of manpower projections are shown, a supply type and a demand type. This provides for a better appreciation of both the expected market situations and also the maximum risk of shortage or surplus situations which may develop (as indicated). Clearly the approach must be accompanied by guiding decision rule criterion of the type discussed in Chapter 1 for uncertainty and thus also there is the requirement for the subjective weighting of surplus and shortage 'outcomes'. While this seems to be much more realistic and lend the manpower requirements approach more credence, it still has notable disadvantages when compared to the CBA approach to the same problem, eg. vastly more data collection, erroneous supply side rigidity assumptions and a lack of money value interpretation. Finally then, how strong is the case for applying CBA to education?

Without any shadow of doubt, the case for and against the use of CBA in education, rests on the theoretical relationship between earnings and education. Most authors agree that earnings over time are a function of human capital and quite conceivably the function is hierarchical in the sense that physical welfare and psychological welfare preceed the effect of the level of knowledge and skills in this function. But given the attainment of the former two aspects of the function we have, by the Horvat formulation, (referred to earlier), a function in which knowledge and skills play the dominant role and the other effects may be ignored. Clearly then, the development of knowledge and skills become all important as society makes economic progress. However, the development of this knowledge is a complex and interdependent function of the relationship between genetic abilities, social environmental influences and education. Thus although it seems almost obvious that earnings must be a function of education, it is inevitable that in taking the next step, that of suggesting the precise nature of this relationship, one could expect considerable debate - and this indeed turns out to be the case. In fact, the lack of consensus is so evident in this respect that one can only conclude that "the debate continues" (see section III).

(ii) SOME THEORETICAL CONSIDERATIONS OF THE RELATIONSHIP BETWEEN EDUCATION AND EARNINGS

(ii.1) INTRODUCTION

In spite of the impression perhaps given in the intial part of this chapter there is, in fact, very little qualification necessary to the assertion that a strong economic rationale underlies the motivation for education in our society. It is almost universally appreciated, at a prima facie level, that human production and consumption abilities are inextricably linked with the mastery of various technical and social aspects of our environment - the process by which this mastery is achieved commonly being described as education. However, notwithstanding this general appreciation, dissension remains - dissension fuelled by the uncertainty of the nature of the mechanisms connecting education with economic progress and in particular, the nature of the mechanism connecting education with increased productivity and thereby, with increased earnings. In the field of the economics of education, it is this topic, the relationship between education, productivity and earnings, which has generated the most interest, and the primary consideration here has been that of economic efficiency in decision making. We have already established in the preceding section that one can consider this decision making in a hierarchical manner, (higher, intermediate and lower order decisions), and that CBA seemed more suited toward the lower two order decision levels. At all three levels of efficiency consideration, one almost intuitively develops a notion of optimality. It is fairly easy to believe education makes some contribution to output, but there must be some point, all the same, at which it ceases to be as contributary as other productive inputs to national output (i.e. an optimal point). If this was not true, there would be an unlimited demand for education and no resources would be used for

the production of anything else. The techniques whereby we are able to develop some guidelines on the matter of allocative efficiency, are CBA (the "elaborate" approach[32]) and statistical estimation of production and earnings functions of education. Clearly the latter is of interest, but not the primary concern of this thesis. The aim of these techniques is, needless to say, to determine the contribution education makes to earnings or the growth in output.

Unfortunately however, research along the above lines has run into considerable interpretive difficulties because of the ambiguity in the relationship between education and earnings already referred to. The confusion arises out of the 'arbitrary' specification of causality between earnings and education in empirical work. The relevant questions here are:-

(a) whether the higher earnings were brought about by higher education or whether the higher education was attained by virtue of being able to afford more through higher earnings and,

(b) what of other factors such as social backround and ability.

A way around the causality impasse, may appear to lie in the comparison of lagged education data with earnings data, but this on closer examination, is what is implicit in a CBA in any case. What precise meaning do we give to the correlation between these two variables then?

One highly respected and influential analysis of this relationship was that of Becker's in, what has become perhaps, to be regarded as a classic in this field, his work "Human Capital"[33]. Consequently, we begin this section with a discussion on some theoretical aspects of this work. From Becker's approach we learn why people who invest in education could experience higher later earnings with age. Mincer, in a major contribution to this field, Schooling, Experience and Earnings,[34] develops this theory into a life-

cycle of earnings model based on the individuals time profile of human capital investment, and some aspects of his model are discussed after Becker's model. The last human capital model we consider is that of Ben-Porath[35]. By Mincer's analysis, the economic rationale of the demand for investment in education at a young age, is to maximize the period of returns to investment - the contribution of Ben-Porath to this analysis, is to integrate with it a more explicit treatment of the supply conditions facing the individual and of particular significance is his introduction of the role of existing human capital itself in the production of human capital function.

An opposing approach to those above, arises out of the major problem with the human capital explanation of earnings variation, namely its reliance on the sensitivity of the labour market (wages) to productivity increases. The faith of those who have adopted the human capital explanation for higher earnings, by virtue of the fact that almost by assumption education must somehow lead to higher productivity, is not shared by all - a major alternative approach to explaining the same phenomenon, based on labour market failure, has developed and will be referred to in this analysis as the 'credentialist' approach. It is also called the screening hypothesis, the certification theory or the dual labour market hypothesis. By this theory, it is <u>not</u> the productivity increases brought about through higher education which lead to higher earnings, but the credentials associated with that education, by employers; and of particular significance here, are the certificates issued by the educational institutions which perform a screening operation for employers - those with higher qualifications being given advantageous employment, rewards and prospects over the others. It seems appropriate therefore, that this particular theoretical standpoint should also be covered in this section and so it is with a discussion of the credentialist approach which this section is concluded. In the next section, "Returns to education the debate

continues", we extend the arguments on the human capital approach to earnings variation yet further.

(ii.2) THE 'CLASSICAL' APPROACH EDUCATION AND EARNINGS - BECKER[36]

Becker's analysis is built on the foundations of the efficient operation of profit maximization forces in a competitive labour market. He distinguishes in his analysis between general and specific training - the former being readily transferable between different employers and the latter gearing the employee up for service to a special (specific) employer only. We begin a description of his analysis by considering the implications of his profit maximization assumption in the labour market with respect to general training and after this consider the implications of the assumption with respect to specific training.

If a firm operates in the labour market on the basis of profit maximization, it would be in equilibrium in a given time period (t), where the marginal product yielded by labour in that time period (MP_t) equalled the wage paid to that labour in that time period (W_t), i.e.

$$MP_t = W_t \qquad \ldots\ldots\ldots \qquad (2.01)$$

This same condition, expressed over n + 1 discrete time periods and encompassing all receipts to the firm from labour per time period (R_t) and all expenditures by the firm on labour per time period (E_t) at market discount rate r, can be expressed in present value form as below.

$$\sum_{t=0}^{n} \frac{R_t}{(1+r)^t} = \sum_{t=0}^{n} \frac{E_t}{(1+r)^t} \qquad \ldots\ldots \qquad (2.02)$$

Now, if we let,

$$\sum_{t=0}^{n} \frac{R_t}{(1+r)^t} = MP_o + \sum_{t=1}^{n} \frac{MP_t}{(1+r)^t}$$

and $\sum_{t=0}^{n} \frac{Et}{(1+r)}t = Wo + \sum_{t=1}^{n} \frac{W}{(1}t\overline{+ r)}t + ko$

, where k_o represents the direct outlay on the training of labour by the firm in the first period, (assuming for simplicity that all training on the job is done in this period, t=0), then the labour market equilibrium condition becomes,

$$MP_o + \sum_{t=1}^{n} \frac{MP_t - W_t}{(1+r)^t} = W_o + k_o$$

, which is equivalent to

$$MP_o + G = W_o + k_o \qquad \ldots\ldots\ldots \qquad (2.03)$$

, where $\sum_{t=1}^{n} \frac{MP_t - W_t}{(1+r)^t} = G.$

Clearly however, equation (2.03) does not incorporate all the costs of training. There is output foregone by the firm while labour is undergoing training which is an additional cost to the firm. The costs of training labour (k_o) inclusive of output foregone by the firm because of this training will be indicated by k_o'. To maintain the equilibrium condition as expressed in equation (2.03) we must also reflect this foregone output on the left hand side. We do this by adding it to MP_o so that it becomes MP_o', thus representing now the full potential marginal product of labour in the absence of training. Incorporating these adjustments, equation (2.03) becomes,

$$MP_o' + G = W_o + k_o' \qquad \ldots\ldots\ldots \qquad (2.04).$$

Now, by equation (2.01), i.e. that the firm only pays wages which equal its marginal product over time, we have G = o and equation (2.04) becomes,

$$MP_o' = W_o + k_o' \qquad \ldots\ldots\ldots \qquad (2.05).$$

The implication of equation (2.05) is, (a) that the employee bears the entire cost of his training, and (b) that he bears it in the period in which he is being trained, i.e. there is no depreciation mechanism in operation. The significance of (b), is that unlike material capital, the full cost human capital acquired by education, is written off immediately.

Such is the situation for the generally trained employee, then. There is no incentive for the employer to bear the risk of paying the trainee in excess of his current net worth to the firm, which is $MP_t' - k_t'$ during his period of training, because for general training the full increased productivity accruing to the trainee is perfectly transferable to other firms. If an employer did take this risk, then in order to remain in equilibrium, by equation (2,04) it would imply $G > 0$, i.e. that the marginal productivity of trained labour exceeded the wage paid to that labour in the $t > 0$ time periods. But this being the case, the other competing employers who continued to pay their labour its net worth to the firm per time period, namely $MP_t' - k_t'$, would bid away all the trained employees from such a firm. It follows then, that no profit maximizing firms would pay for general training in any time period provided to its employees because if this was the case, trainees would receive their training at the firm paying wages in excess of $MP_t' - k_t'$ but immediately on completion of training, transfer to firms continuously equating their employees net worth to the firm, with wages.

To sum up then, it is an inevitable consequence of profit maximization with respect to the hiring of labour that trained persons experience lower earnings during the time periods in which they undergo their training because they pay for it at the time, and higher earnings at later ages because it is then that they collect the full return to their investment in training. Expressing these conclusions

in terms of age-earnings curves, Blaug had this to say -

> "the combined effect of paying for and collecting the return from training.... would be to make the age-earnings curve of trained persons....steeper than that of untrained persons, the difference being the greater cost of, and return from, the investment." 37

However, not all training is general, some training is specific to the firm providing the training, in the sense that it only increases the productivity of labour in the firm providing the training - familiarization courses for new employees are a good example. A fundamental difference between general training and specific training is that in the latter case the employee lacks any incentive to transfer employment to that of another firm by virtue of the fact that his employer paid him in excess of his net worth to the firm during his period of training. No other employer would be prepared to reward his specific training because it offers no realizable productivity improvements in their situation. If the employee did transfer to another employment having been paid in excess of his net worth to the firm during his period of specific training, both the employer and employee would stand to lose: the employer because he would have lost an investment and the employee because his new employer would not be able to reward him for this specific training at all. Thus we would expect less movement between 'alternative' employers of specifically trained labour. However, we have yet to establish any reason why employers would behave differently from general trainees towards specific trainees. The rationale for this seems to lie in the understanding by the firm that the sharing the costs of specific training is likely to promote staff stability and loyalty and thereby promote a healthy continuity of production in the firm. This being the case, we would expect some sharing of specific training costs between employers and employees during the periods of training, to occur. The basis of the division of these costs would presumably be determined by such

variables as quit rates, the profitability situation, attitudes toward risk, the cost of funds and the desire for liquidity. Of these variables,the most significant in terms of Becker's analysis of specific training, is the rate of labour turnover, (the quit rates), and in the light of the above discussion we would expect this to be substantially lower than that for generally trained labour.

An interesting corrollary to his analysis is the expectation that in a recessionary climate, there would be lower lay-off rates for specifically trained labour, because $G > 0$ i.e. $MP_t > W_t$, than for generally trained labour. Another interesting corrollary emerging from the analysis is the claim that it provides an alternative to the standard explanation for $MP_t > W_t$ where monopsony prevails. The standard explanation of this phenomenon relies on the appreciation of the monopsonist of his wage determining power and his use of this influence on the labour market. Becker argues alternatively, that monopsony power tends to make training more specific in character because movement between employers (by definition) becomes almost impossible. Elaborating further, he contends that in such a situation employers would also be more inclined to invest in training their employees - a further reason to expect $MP_t > W_t$ under monopsonist conditions.

Although Becker's analysis is conducted from an on-the-job point of view, it is readily applicable to schooling as well. Schooling is analyzed as a case of 'pure' general training and it follows immediately that the earnings behaviour of the school trained labour can be represented by equation (2.05). The vital significance of this for CBA purposes, is that it permits us to conclude that the higher later earnings of more highly schooled persons may be taken to reflect the return on investment in education.

However, while his analysis provides us with a very reassuring result in this respect, it also highlights a very severe complication which emerges in any attempt to isolate a return on a particular type of schooling - that of separating the returns on schooling from returns to on-the-job training, which is unavoidably present, though in varying intensities, in any employment. Thus the measure of various returns to labour belonging to particular education cohorts will always include a return to on-the-job training as well as schooling and the inevitable conclusion which follows, is that the rates of return to schooling calculated from earnings data are an average rate of return to both schooling and on-the-job training,(although use of Mincer's overtaking concept may in principle be used to avoid this problem [38]). By 'on-the-job training', any training provided by the firm is meant.

Eckaus [39] has queried Becker's analysis on this very issue - the lack of precision in the concept of on-the-job training. He feels that deliberate training schemes (which can, in principle, be precisely costed) by firms are not as important as informal learning by doing and watching others, (which lacks any precise cost determinability). "The relatively informal, unorganized type of vocational training through casual instruction and as a joint product with actual work experience is, I believe, much more significant."[40] He suggests that the question of who bears this cost does not emerge clearly out of Becker's analysis. But perhaps Eckaus's key observation was that Becker underestimates the impact of market imperfections in his main conclusions - a fact later verified by the rise of the rival thesis to the human capital approach to earnings, namely the credentialist approach.

(ii.3) THE LIFE-CYCLE OF EARNINGS APPROACH (HUMAN-CAPITAL EARNINGS FUNCTIONS) - MINCER[41]

Mincer's pioneering work in human-capital earnings functions introduced some very useful and novel elements into the human capital approach to explaining the life-cycle of earnings. The first model we consider is that of a human-capital investment function in which time is a continuous variable. Consequently, continuous compounding functional relations replace the discrete compounding functions which we have used so far. As earnings are generally discretely realized, the latter has relevance, but ideally if (as human capital theorists do) we tie earnings to productivity improvements, then assuming this to be a continuous process, the treating time as a continuous variable is perhaps more accurate. To clarify the connection between the discrete and continuous discounting (which is merely the inverse of compounding) functional relations, a few elementary calculus concepts are utilized. The product of this analysis, the primative form of the continuous human-capital investment function, is not of much use on its own however, as there is very little is incorporated in the function. Consequently, a second more comprehensive model is developed, where along with schooling, initial earnings, the impact of on-the-job training, experience and depreciation of human capital are incorporated - all however, in a discrete time context. We also look briefly at Mincer's approach overcoming the problem raised in Becker's analysis of returns to schooling being inclusive on-the-job training.

(a) A DERIVATION OF THE PRIMITIVE HUMAN-CAPITAL RETURNS-TO-INVESTMENT FUNCTION

In the analysis which follows, we define Yj as the total return on various investments in human capital, Cj as equal investments over different time periods

in human capital, j as the number of years on which there is a return on investment, r(which is determined from the alternative investment opportunities in the capital markets) as the compound rate of interest per annum earned on the human capital investments, t as any year, (0, 1,2...j-1), i.e.a total of j possible year periods and $\triangle t$ as the discrete compounding time period per year.
Now it can fairly easily be demonstrated that the discrete form of the compound investment function is,

$$Yj = Cj \sum_{t=0}^{j-1} (1+r\triangle t)^{t/\triangle t}, \quad \ldots\ldots \quad (2.06)$$

, given the definitions above. This may be written exactly equivalently in discount form, as shown below in equation (2.07).

$$Cj = Yj \sum_{t=0}^{j-1} (1+r\triangle t)^{t/\triangle t}, \quad \ldots\ldots \quad (2.07)$$

In equation (2.07) Cj is termed the present value and is directly analogous to the NPV formula discussed in the investment criterion section of chapter 1 (with $\triangle t=1$). The only other terminological change is that r now becomes the discount rate. For the purposes of CBA we use equation (2.07), but as we would expect productivity improvement, through human capital investment to be of a more continuous nature, present value functions continuous in time are more realistic. It is interesting to note that although recognition of this productivity improvement in the form of higher earnings is more discrete in nature, human capital theory does not theoretically allow for this - the problems of productivity recognition are ignored in human capital and are now regarded as part of the domain of credentialist analysis.

The only mathematical difference between a discrete compound function and a continuous compound function

is in the tendency of Δt. In the discrete function form, it is normally taken as unity and ignored. However, where time is treated as a continuous variable, Δt tends towards zero. This is incorporated by taking the limit of function (2.07) as Δt tends toward zero, i.e.

$$C_j = Y_j \lim_{1/\Delta t \to \infty} \sum_{t=0}^{j-1} (1+r\Delta t)^{1/r\Delta t - rt}$$

$$= Y_j \int_0^{j-1} e^{-rt}\, dt, \quad \ldots\ldots \quad (2.08)$$

, using as motivation, the definition of e,

$$e = \lim_{n\to\infty} \left(1 + \frac{1}{n}\right)^n,$$

and the definition of an integral,

$$\int_a^b f(t)dt = \lim_{\Delta t \to 0} \sum_a^b f(t)\,\Delta t.$$

For the purpose of utilizing equation (2.08) in the establishment of a human capital linked life-cycle-of-earnings model, we let s be the years of schooling undergone by an individual and n be his fixed working life in years, so that his present value function of earnings is

$$C_s = Y_s \int_s^{n+s} e^{-rt}\, dt. \quad \ldots\ldots \quad (2.09).$$

If we considered the same individual, but with d years less in schooling, his present value of earnings potentially would have been,

$$C_{s-d} = Y_{s-d} \int_{s-d}^{n+s-d} e^{-rt}\, dt \ldots\ldots \quad (2.10).$$

But by definition Cj were constant and thus $C_s = C_{s-d}$, and it follows that,

$$Y_s \int_s^{n+s} e^{-rt}\,dt = Y_{s-d} \int_{s-d}^{n+s-d} e^{-rt}\,dt$$

$$, \text{ or } \frac{Y_s}{Y_{s-d}} = \frac{e^{-r(s-d)}}{e^{-rs}}$$

$$, \text{ or } Y_s = Y_{s-d}\, e^{rd}$$

$$, \text{ and thus } \log Y_s = \log Y_{s-d} + rd \quad \ldots . \qquad (2.11),$$

for estimation purposes.

This (equation 2.11) is what Mincer discribes as the 'primative form' of the human capital investment function. Notice that directly from equation (2.11) we have

$$r = \frac{\log Y_s - \log Y_{s-d}}{d} \quad \ldots\ldots \qquad (2.11a)$$

, which provides the rationale underlying the rate of return estimations were dummy variables per level of schooling are used in an earnings function approach (see section (1.II iv 4)).

(b) MORE SOPHISTICATED FORMS OF THE HUMAN-CAPITAL EARNINGS FUNCTION

Earnings are made up of more than just returns to investments in human capital as described by equation (2.11). Before any schooling, an individual has an initial earnings capacity and after schooling, on-the-job training makes a further contribution to earnings. We have already established from Becker's analysis that the individual will invest in his own general on-the-job training and receive his return in the form of higher earnings later. Mincer extends this principle, explaining life long earnings, given initial earnings capacity, in terms of continuous returns on educational investment as reflected in

equation 2.19 below. As with the previous analysis we begin with some definitions. E_j is defined as the individuals gross earnings capacity in year j and thus E_o defines the individuals initial earnings capacity. Y_j is redefined now, to be the individuals take-home pay after human capital investments, and $\hat{j}$ is defined to be the year when the earnings of the more educated individual overtakes those that he would have got had he not opted for the further investment in his education. All other definitions remain as they were in the previous model, although note that time remains a discrete variable in this analysis.

In the first year of working, j = 0, the individual earns, (by the definitions above),

$$Y_o = E_o - C_o.$$

In the second year he earns interest on his first years human capital investment of r and hence,

$$Y_1 = E_o + rC_o - C_1 = E_1 - C_1.$$

By similar reasoning we have,

$$Y_j = E_{j-1} + rC_{j-1} - C_j \quad \ldots\ldots \quad (2.12)$$

$$= E_o + \sum_{t=0}^{j-1} rC_t - C_j \quad \ldots\ldots \quad (2.13)$$

$$= E_j - C_j \,, \quad \ldots\ldots \quad (2.14)$$

which may be written equivalently as

$$\frac{Y_j}{E_j} = 1 - \frac{C_j}{E_j} \,,$$

, which in turn, by defining $f_j = \frac{C_j}{E_j}$, we may write as

$$Y_j = (1 - f_j)E_j \quad \ldots\ldots \quad (2.15).$$

We may interpret f_j as being the fraction of time a worker devotes to improving his earning power. Thus, except for the years of schooling, when f_j may be assumed to be unity, it would be less than one. Now, from equation (2.12) and (2.14) and the definition of f_j, we have that,

$$E_j = E_{j-1} + rC_{j-1}$$

$$= E_{j-1}(1 + r f_{j-1})$$

$$= E_o \prod_{t=0}^{j-1} (1 + rf_t) \quad \ldots\ldots \quad (2.16),$$

and by substituting this recursion relation into equation (2.15),

we obtain, $Y_j = E_o \prod_{t=0}^{j-1} (1 + rf_t)(1 - f_j) \ \ldots \ (2.17).$

Equation (2.17) is the basis on which models are built in Mincer's analysis. By expressing it in log form we get,

$$\log Y_j = \log E_o + \sum_{t=0}^{j-1} \log (1 + rf_t) + \log (1 - f_j)$$

, which for small r may be approximated as,

$$\log Y_j = \log E_o + \sum_{t=0}^{j-1} rf_t + \log (1 - f_j) \quad \ldots \ (2.18).$$

At this stage of the analysis, it is necessary to consider what assumptions one is going to make about the rate of return, r, on the time the worker devotes to improving his earnings power through human capital investment, i.e. f_t. If we allow for one rate of return r_s, on years of schooling S, (remembering $f_t = 1$ during schooling) and another rate of return r_{ps}, on post-school on-the-job training, equation (2.18) becomes,

$$\log Y_j = \log E_o + r_s S + r_{ps} \sum_{t=s}^{j-1} f_j + \log (1 - f_j) \ldots \quad (2.19),$$

, which is the basis of the earnings function approach to rate of return to education estimation - see Chapter 1 section (II.v.3). Taking $\log (1 - f_j)$ over to the left hand side of equation (2.19) and using equation (2. 15) this may be written as,

$$\log E_j = \log E_o + r_s S + r_{sp} \sum_{t=s}^{j-1} f_t$$

$$= \log E_o + r_s S + r_{sp} \; g(f,t) \quad \ldots\ldots \quad (2.20)$$

In equation (2.20) the summation of f_t is replaced by a function g in f and t. The role of this function g(f,t), is to relate the effect of on-the-job training and experience to earnings, and using the earnings patterns which seem to have emerged from various studies, (see figure 2.1), one would expect the nature of g(f,t) be such that the first order derivative of earnings with respect to time would be positive but that the second order derivative of earnings with respect to time would be negative. In his estimations Mincer[42] derives g(f,t) such that the characteristics of it are as described above. For example, a "parabolic experience type function" and a "Gompertz type function" are derived where the former is,

$$g(f,t) = f_o t - \frac{f_o t^2}{2T}$$

, where $f_o = \frac{C_j}{E_o}$ and T = the positive net investment period,

and the latter is,

$$g(f,t) = \frac{f_o}{\beta} \; (1 - e^{\beta t}),$$

, where $\beta = \frac{\Delta C_j}{t_o}$, (i.e. the annual decline in f_o)

Psacharopoulos and Layard,[43] in a critique of Mincer's approach, point out that his model, if used for rate-of-return to education estimations, permits no relationship between the S and $r_{sp}g(f,t)$ in the earnings equations above - a result which they find conflicts with their estimations.

One of the major difficulties which emerges out of the above method of estimating rates of return to schooling is due to the presence of the g(f,t) function. A method proposed by Mincer, designed to overcome difficulties related to this, uses the concept of an "overtaking" year, where a person's actual current earnings Y_j, would equal his potential earnings with schooling but no training, E_s. Where this is the case,

$$Y_{\hat{j}} = E_s$$

(remembering that $\hat{j}$ is the year of overtaking), which implies,

$$C_{\hat{j}} = \sum_{t=s}^{\hat{j}-1} r_{ps} C_t \qquad \text{(using equation 2.13)}$$

$$= r_{ps} (\hat{j}-s) C_{\hat{j}}$$

, or $$\hat{j} = \frac{1}{r_{ps}} + S \qquad \ldots\ldots \qquad (2.21).$$

The importance in the year of overtaking is that it relates to a period (Mincer estimates 7-9 years after schooling[44]) when people are least different as a result of their post-school investments because there is no net positive or negative effect

on earnings due to post-school investment. Thus, by merely concentrating on accounting for the variation in earnings between people of different schooling cohorts in the "overtaking" year, estimates of differences in earnings due to schooling but not training are obtained (and hence rates of return to schooling).

The method is fairly straight forward - the year of overtaking must be determined, an assumption that $\hat{j}$ is the same for all schooling cohorts (so that the net effect of post school training may be ignored) must be made, and finally from the regression, $\log Y_{\hat{j}} = \log E_o + r_s S$ + (error term), which is estimated from year $\hat{j}$ data, r_s, the return to schooling, follows. The difficulty with this method is however, determining $\hat{j}$ and from equation (2.21), as it is evident that r_{ps} is required before this is possible. One way around this difficulty is to use a "cross-over"[45] year in the place of the overtaking year. The problem with using an overtaking year is it uses a potential earnings concept (E_s), which can't be measured. However, using the "cross-over" year at which the earnings of different individuals of different schooling cohorts are equal, is identifiable, and it is by this method that Mincer suggests $\hat{j}$ and hence r_s may alternatively be estimated. Using the above mentioned approach Mincer is able to explain half earnings inequality in the U S due to human capital formation.[46] Psacharopoulos and Layard however, feel that this is an overestimate "since it assumes that all the increased variance in log earnings in later life is due to human capital, that costless learning from work experience is impossible and that schooling is uncorrelated with ability, opportunity and other determinants of earnings".[47]

A final consideration in this analysis with respect to the human capital earnings model which we have

outlined,is that of depreciation. In the analysis outlined so far, the depreciating effect of time on the individuals stock of human capital has not received attention. However, there is clearly a strong case for building into the human capital model some allowance for the depreciation of the stock of human capital - the finiteness of age, increasing illness with age, memory limitations and the acceleration of technological change are some considerations in motivation for this. Furthermore, introducing the principle of a rate of depreciation of the stock of human capital over time presents no particular problem.

Letting m be the annual rate of depreciation of the stock of human capital, and recognizing that the worth of human capital in the individual may be represented at any time j, by $\sum_{t=0}^{j-1} rC_t$, the total amount of depreciation for t = j years is $\sum_{t=0}^{j-1} rC_t m$. We may show the affect of this on gross earnings capacity by subtracting it from the right hand side of equation (2.13), i.e.

$$E_j = E_o + \sum_{t=0}^{j-1} rC_t - C_j - \sum_{t=0}^{j-1} rC_t m$$

$$= E_o + \sum_{t=0}^{j-1} (1 - m)\, rC_t - C_j$$

and where r* is defined as (1 - m)r, this becomes

$$E_j = E_o + \sum_{t=0}^{j-1} r^* C_t - C_j \quad \ldots\ldots \quad (2.22)$$

Equation (2.22) replaces that of (2.13) in the analysis which continues as before. (Note that Mincer does not actually merge r and m,as done above.)

(c) THE SIGNIFICANCE OF MINCER'S APPROACH - A CONCLUDING COMMENT

It should be clear that Mincer's model is not specifically geared towards the estimating of rates of return to education, it is more generally targeted - namely at providing a comprehensive human capital theory of the life-cycle of earnings. However, this is not to say that his contribution to rate-of-return estimation is negligible. The human capital earnings function approach, of the type developed here, has served as a framework for the bulk of research on the human capital explanation for earnings variation over the last decade. One reason for this, is that investigation of the human capital earnings theories, by the use of earnings functions, allows for the direct consideration of the multitude of other factors which could initiate earnings. Within this context we learn more about the relative contribution of education to earnings. Having established some sort of consensus on this issue, the CBA results may be more precisely interpreted. For example, if by statistical estimation of earnings functions, it emerges that education only accounts for two-thirds of earnings variation, the implication for CBA is that only two-thirds of earnings variation may be attributed to education. In section (III.ii) of this chapter a little consideration is given to just how much of earnings variation does appear to be associated with education.

(ii.4) CONSIDERATION OF HUMAN CAPITAL PRODUCTION IN THE LIFE-CYCLE OF EARNINGS APPROACH: BEN-PORATH[48]

In the two models outlined so far the focal point of attention has been on why individuals invest in education - the economic reason being primarily in terms of their

return on investment. Ben-Porath's model combines this 'demand' for human capital theory with a more explicit treatment of the supply conditions confronting the individual who has this option of investing in human capital - the basis for his treatment of the supply conditions being the specification of a human-capital production function. The discussion of his model is begun with the definition of the supply conditions determining human capital output. Then, with a view to determining optimal human capital output, this is integrated with a "demand price" concept and some implications of this explored. Finally, some general comments on his approach are made.

(a) THE SUPPLY CONDITIONS IN HUMAN CAPITAL PRODUCTION

As with Mincer's analysis, we begin with a few definitions. K_t is defined as the homogenous stock of human capital at time t, of which everyone has an initial endowment. Consumption is assumed to be independent of K_t. a_o is the rental rate on K. Y_t is defined as an individual's earnings capacity at time t and is solely a function of the rental on his stock of human capital, i.e. $Y_t = a_o K_t$. The individual allocates these earnings to expenditure on non-human assets (E_t) and investment in human capital (I_t),

, i.e. $Y_t = E_t + I_t$.

Combining these definitions we get,

$$a_o K_t = E_t + I_t \quad \ldots\ldots\ldots \quad (2.23).$$

Finally, the production (output) of K per period, is defined as Q_t. Q_t is specified as being a function of the existing human capital allocated to the production of further human capital ($S_t K_t$, where $0 < S_t < 1$, although we consider later, the cases of $s_t = o$ and $s_t = 1$), and the quantity of purchased inputs (D_t),

i.e. $Q_t = B_o (S_t K_t)^{B_1} D_t^{B_2}$ ..... (2.24)

, where $B_o, B_1, B_2 > 0$ and $B_1 + B_2 < 1$, by assumption.

The cost of these inputs into the production of human capital Q_t are made up of payments to $S_t K_t$ and D_t (existing human capital and other inputs respectively). We have already defined the market cost of human capital to be a_o, but we have not yet defined a price for the other inputs (D_t) into human capital production. Let this price be P_d. Thus, the investment cost of producing Q_t may be defined as,

$$I_t = a_o (S_t K_t) + P_d D_t \quad \text{.....} \quad (2.25),$$

, the first part of the right hand side of (2.25) being foregone earnings and the second part, being the direct outlay on education.

We may derive the cost minimizing human capital investment conditions by taking the derivative of equation (2.25) subject to the production function (2.24) with respect to either production inputs, and substituting these cost minimization conditions back into equation (2.25) - see below. The cost minimization condition for human capital inputs in equation (2.25) is

$$0 = \frac{d I_t}{d(S_t K_t)} = \frac{\partial I_t}{\partial S_t K_t} + \frac{\partial I_t}{\partial D_t} \frac{d D_t}{d S_t K_t}$$

$$= a_o - p_d \left(\frac{Q_t}{B_o}\right)^{\frac{1}{B_2}} \left(\frac{B_1}{B_2}\right) \left(S_t K_t\right)^{\frac{-B_1}{B_2} - 1}$$

, which may be written equivalently as

$$S_t K_t = \left(\frac{B_1 P_d}{B_2 a_o}\right)^{\frac{B_2}{B_1 + B_2}} \left(\frac{Q_t}{B_o}\right)^{\frac{1}{B_1 + B_2}}$$

, or $P_d D_t = \frac{B_2}{B_1} a_o S_t K_t$

, where $D_t = \left(\frac{Q_t}{B_o}\right)^{\frac{1}{B_2}} \left(S_t K_t\right)^{\frac{-B_1}{B_2}}$

Substituting these cost minimization conditions into equation (2.25) yields equation (2.26) below:

$$I_t = \left(\frac{B_1 + B_2}{B_1}\right) a_o \left(\frac{B_1 P_d}{B_2 a_o}\right)^{B_2/(B_1 + B_2)} \left(\frac{Q_t}{B_o}\right)^{1/(B_1 + B_2)} \quad \ldots\ldots \quad (2.26).$$

Hence, the marginal cost of production (the supply curve) is defined by

$$MC_t = \frac{dI_t}{dQ_t} = \frac{a_o}{B_o B_1} \left(\frac{B_1 P_d}{B_2 a_o}\right)^{\frac{B_2}{B_1 + B_2}} \left(\frac{Q_t}{B_o}\right)^{\frac{1}{B_1 + B_2} - 1} \quad \ldots\ldots \quad (2.27),$$

, i.e. a positive exponential type function of P_d and Q_t passing through the origin. This makes sense, as we would expect both the costliness of a persons own time (in foregone earnings) and other market resources to accelerate as the input of these 'scarce' factors was increased for the production of K. The shape of the MC_t curve is depicted graphically on the following page.

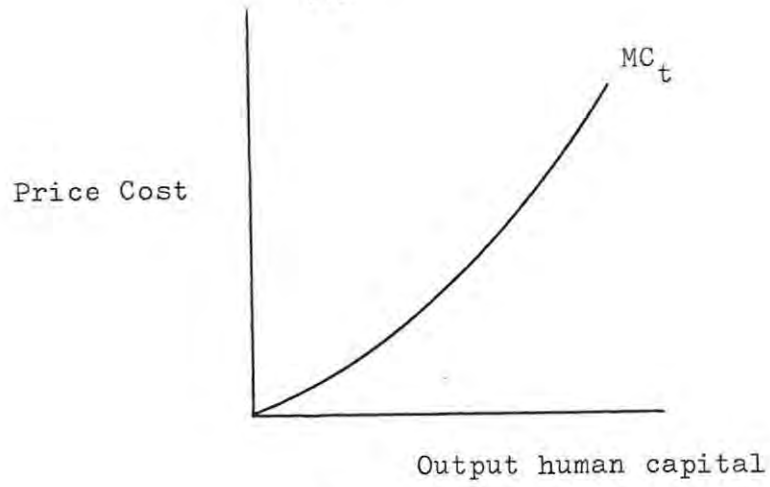


Figure 2.3

Note that decreases or increases in the cost of non-human capital inputs and or rental on capital, would have the effect of shifting the MC_t curve to the right or left, respectively.

(b) THE INTEGRATION OF THE SUPPLY CONDITIONS FACING HUMAN CAPITAL PRODUCTION WITH ITS "DEMAND PRICE"

Having determined the cost conditions facing the individual in his production of human capital, we merely require a demand price in order to determine a so-called optimal output of human capital. Ben-Porath, in the spirit of the human capital approach, defines the "demand price" as the present value at time t of additional earnings brought about through the production of a unit of human capital ($Q_t = 1$), on which we allow a constant depreciation rate per annum of m. Letting T mark the upper time limit on which earnings on this human capital are obtained and assuming that the capital market conditions secure a constancy of interest rate, r, we have,

$$P_t = a_o \int_t^T e^{-(r+m)v} \, dv \qquad \ldots\ldots \qquad (2.28),$$

, where P_t is defined as the "demand price" of human capital.

Performing the integration in equation (2.28) we get,

$$P_t = \frac{a_o}{r + m}(1-e^{-(r+m)(T-t)}) \quad \ldots\ldots \quad (2.29).$$

The demand price is not a function of Q_t. It is determined by the capital market rate of interest, the market determined rental on human capital, the exogeneously determined m and (T - t), the time horizon. The latter is clearly a variable which the individual dictates. The greater (T - t), which implies the earlier the completion by the individual of his education, the greater P_t. This implications of this are made quite clear in figure 2.4

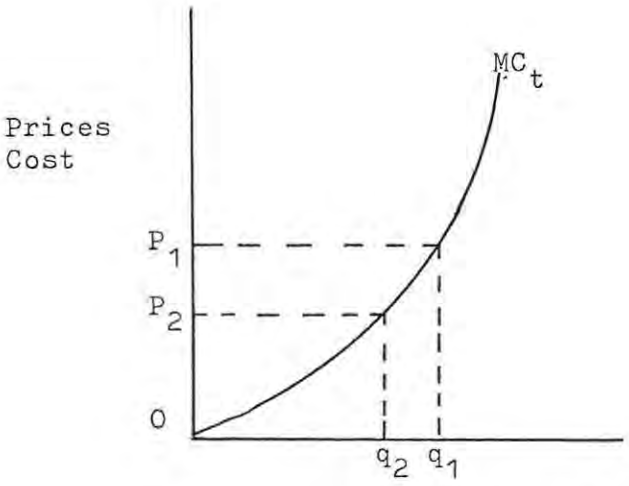


Figure 2.4

If the individual completes his education young, at t_1 say, he has a "demand price" of P_1, whereas if the individual completes the same education later, say at t_2, where $t_2 > t_1$, then his "demand price" would be P_2. Clearly, the disadvantage of delaying

education, is that in this case less human capital is demanded (supplied) than otherwise - in figure 2.4 (q_2 q_1 less).

(c) SOME IMPLICATIONS OF THE MODEL

One of the most interesting aspects of the Ben-Porath model is its use of the concept of the production of human capital being dependent on the existing stock of human capital, K_t. In the human capital production function specified by equation (2.24) we see that the nature of the relationship between K_t and Q_t is determined by parameters S_t and B_1. B_1 is the measure of existing human capital's relative contribution to Q_t and is derived from the technical relations of the production function. From the analytical point of view, perhaps of more interest is S_t, the amount of K_t allocated to Q_t. (Note that by definition we have up till now assumed $0 < S_t < 1$).

Ben-Porath suggests that the values of S_t correspond to three phases in the life-cycle.

(I) The first is where K_t is so small that even when fully allocated ($S_t = 1$) to the production of Q_t, it fails to meet demand at the relevant price. This means that to meet the higher demand for Q_t that the D_t inputs must increase, thereby increasing costs at a higher rate than anticipated by our MC curve (where $S_t < 1$). This effect is shown in figure 2.4 by the MC_t curve shifting left to MC_2. Notice how it causes a reduction in the production of human capital from that which occurs where S_t is not forced to its limit point, namely where $0 < S_t < 1$.

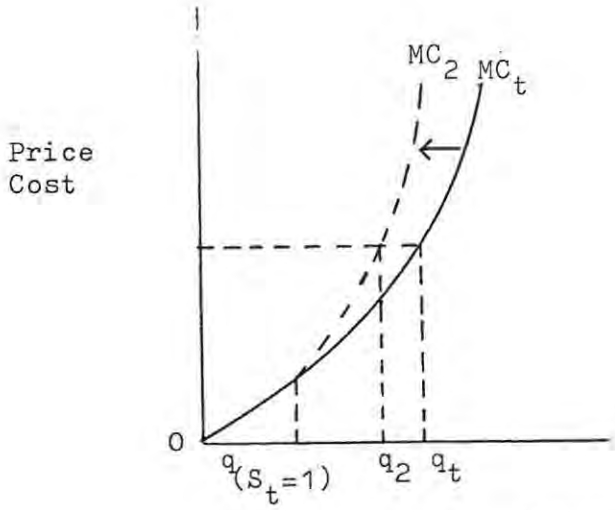


Figure 2.5

In figure 2.5 we see that the effect of a very low 'initial' stock of human capital on the marginal cost of producing human capital, is to shift the MC_t curve left to position MC_2 beyond point $q_{(s_t = 1)}$ which marks the point at which K_t becomes constrained in the production function (2.24). The reduction in the output of human capital is $q_2\ q_t$, given a price of P_t, at this phase in the life-cycle.

(II) The second phase corresponds to that of the model. There is more than sufficient K_t to meet that which is demanded. Thus $0 < S < 1$, as in the model described, and K_t and the function Q_t are thus unconstrained.

(III) The third phase possible is that where K_t is so large that a negative Q_t (i.e. disinvestment) is optimal, but of course not possible, because S_t must be bounded below by zero by virtue of the inalienable nature of human capital. Naturally in

this case there is no production of human capital and a marginal cost curve is irrelevant.

(d) GENERAL COMMENTS ON THE BEN-PORATH MODEL

Ben-Poarth's approach provides a useful structure for analyzing the relationship between human capital formation through education and earnings, and it is this theoretical contribution which makes the model so noteworthy. His model itself is quite capable of explaining the character of the age-earnings profile[49] as has been revealed by empirical work, but by his own admission-
"by writing down a simple production function of the sort used here we are attempting, not to reproduce this system, but only to provide a framework within which some of the possible characteristics of the technology can be considered and their implications studied."[50] There are clearly a host of technical and other relations left out, eg. the role of health, social and political circumstances and the nature of instruction. Notwithstanding this, perhaps some useful insights are provided. A notable example, is the clear importance of encouraging human capital formation at as young an age as possible. There are two reasons for this - one being a declining demand curve for later education brought about by increased foregone earnings and a reduced earnings return time horizon, and a second being the inhibiting affect low initial stocks of human capital have on further human capital formation, as reflected in the shift of the supply curve to the left in figure 2.5.

In the theories of Becker, Mincer and Ben-Porath we have developed a fairly substantial framework for treating educational expenditure as an investment, and it is a framework which very readily explains

the characteristics of various life-cycles of earnings patterns for educated people. For the purpose of CBA, this is of considerable consequence in that it provides the rationale for treating earnings as returns to human capital investments. But although we use the above theories as motivation for the application of CBA to education, opposing theoretical approaches are not without support. The other major (rival) approach to the human capital explanation of the earnings-education relationship, is that of the credentialist's.

(ii.5) THE CREDENTIALIST APPROACH

"The question whether earnings differentials between more and less educated individuals reflect differences in their contributions to national income might be fairly said to constitute the 'Archilles Heel' of rate-of-return analysis"[51]

In an economy where employers were maximizing profits and competing for labour, the use of a simple neo-classical analytical framework, suggests that for generally trained labour, wages should equal the marginal revenue product of labour. Assuming, (a) that there are diminishing returns to trained labour inputs, (and thereby a decining marginal revenue product of labour curve), and (b) that 'trained' labour becomes increasingly costly with increased employment due to it's price being bid up as it becomes scarcer, (and thereby a rising marginal cost of hiring 'trained' labour curve), we have the situation as depicted in figure 2.6, where MRP_L is the marginal product of labour curve and MC_L is the marginal cost of labour curve.

If firms follow profit maximizing behaviour they will employ N_e trained labourers at equilibrium wage W_e, where the marginal cost of labour just equals the marginal revenue product of labour - a point established in Becker's

analysis. It would appear then, that by the profit maximization assumption, that earnings will, at all levels, reflect the value of the marginal productivity of labour. Human capital theorists take this as their point of departure and build their 'demand price' theory on this basis. Unfortunately however, this has proved to be a rather contentious foundation. The credentialist attack on this foundation comes from both the 'demand' and 'supply' sides - the common thread in both attacks being the assertion of some form of market failure.

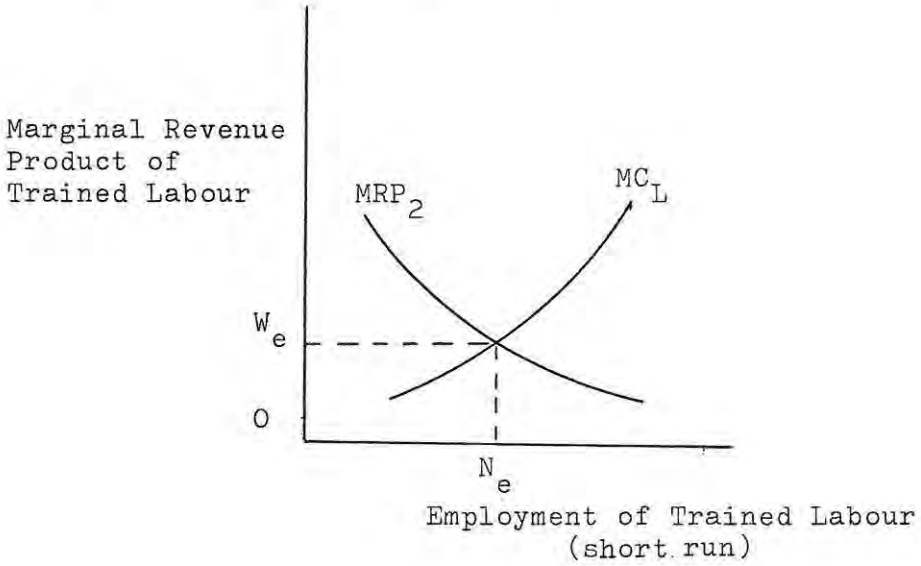


Figure 2.6

(a) THE 'DEMAND SIDE' CREDENTIALIST ATTACK

In figure 2.6 the notion of a marginal revenue product was used to 'derive' a demand curve for trained labour. Employers adjusted their employment level in line with the value of the marginal productivity of an extra unit of labour. This required (a) that completely homogeneous labour (for a given occupation) existed and (b) that the marginal

productivity of this labour was known to the employer. Assumption (a) is not completely necessary if, instead of interpreting the marginal revenue product curve as that pertaining to a whole bracket of equivalent labour, we interpret it merely as reflecting differing labour productivities - each point on the curve representing the marginal revenue product of a particular labourer. However, assumption (b) is essential to the analysis, whatever interpretation is given to the marginal revenue product curve, and herein lies the problem, (b) is not a realistic assumption to make. We cannot just assume that the employer knows what the productivity of a particular labourer is before hiring him. Before any information is conveyed to the employer by the prospective employee, the employer must in the normal course of events be largely unaware of the potential productivity of the employee. The employer does however, have a certain job in mind for the prospective employee and thus does have an expected productivity (within his organization's context) to which he wishes to match the employee. Of necessity therefore, a process is initiated whereby the prospective employee communicates relevant information to the employer to enable the employer to decide on which productivity situation to place employee in. It is a process whereby a plethora of personal observable data on the attributes of the individual are communicated to the employer - data such as education, previous work experience, age, sex, race and perhaps other backround factors. Taking these to be the credentials of the employee, (which we could describe as a credentials vector), the employer then slots the employee into an 'appropriate' productivity role. Critics[52] of this approach have found it incongruous that the employer trusts these 'observable' phenomenon over his own productivity

assessment tests. The response to this is generally that the costs of this operation are very substantial - so much so, that by the credentialist view, it is less costly for the firm to differentiate wages on the credentials basis than it is to attempt its own productivity on-the-job assessments. If we argue, then, that education is of considerable importance in the credentials vector, it follows that it fills a key role in providing access to higher productivity jobs and thus the higher earnings jobs. An extension to this analysis is provided by considering the employers reaction to the signals 'sent' by the employee. Spence[53], for example, incorporates employer attitudes toward risk with the credentials vector in determining wages in his analysis. He distinguishes between an unalterable part of the credentials vector, eg. sex and race, and an alterable part, eg. education, and terms the employee's cost of manipulating the latter, as the "signalling cost". The similarity between the human capital concept of investment expenditure on education (to improve labour productivity) and the 'signalling cost' on education (to demonstrate to the employer greater ability to perform high productivity jobs), is almost sufficient to erroneously gain the impression that economists are fast approaching theoretical reconciliation on the human capital versus credentialist debate over earnings.

The proposition that earnings do not reflect the marginal revenue product of labour, emerges from a more extreme credentialist stance. Here the argument is that hiring practices do not operate on the basis of productivity considerations at all - educated personnel are paid more than the other employees for reasons other than productivity, eg.

the snob value of having educated personnel on the staff, or by a mistaken belief perpetuated by society that education, per se, is always worthwhile. The problem with this argument is that it is not really tenable where profit maximization is permitted as an underlying analytical assumption. It would always be possible for employers not 'mistaken' about the worth of education to force those who were so 'mistaken' out of business, by being able to pay their employees less and thus charging lower prices for their products, (ceteris paribus).

In the credentialist views presented so far we have suggested two extremes - a productivity orientated signalling approach, which leads us to conclusions almost identical to those yielded by human capital theory and a 'mistaken worth of education' approach, which failed to accommodate the profit maximization motive. A more refined credentialist approach has now emerged, which draws a little on both of these approaches. By this approach education is not recognized as enhancing productivity, per se, but through the existing system of social values, (eg. a 'mistaken' worth of education), it is argued that the educated get preferential access to positions and career paths which enable them to attain higher levels of productivity and thus earn more. Taubman and Wales[54], who subscribe to this theory, in order to test it, derive the concept of a "free entry" occupational distribution for each educational group. For each individual they determine a credentials vector and calculate from this what his most rewarding occupation would be, and thus, his maximum potential wage. This is compared to the actual distribution of high and low paid jobs for each educational group, and it is found that the less educated group were far less able (a

third to a half) to reach their maximum earnings situations than the more educated group. They conclude that this constitutes evidence of the social restriction to the "free entry" of the less educated to higher earnings jobs which they were just as capable of doing. The process of social restriction they label as screening, but as Psacharopoulos has pointed out, it smacks more of 'discrimination.'[55]

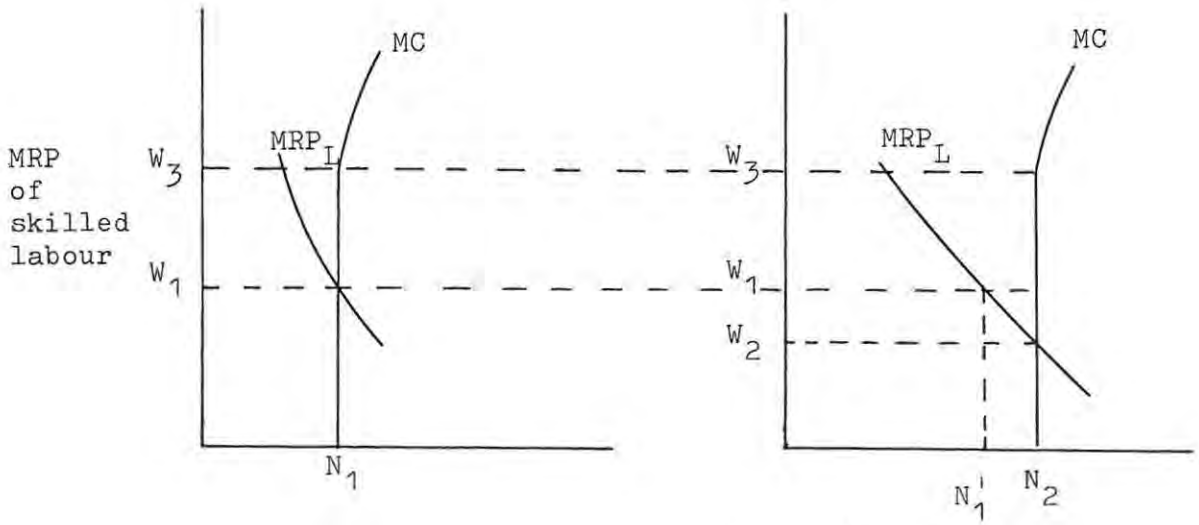
Whatever the term used to describe this practice, the implications are far reaching for social rate-of-return to education analyses - private rates of return to education are not affected. The social rates of return to education should be much less than is suggested by earnings variation, if we accept the impact of Taubman and Wales's research - in fact, by their calculations, a third to a half less than is conventionally calculated on the basis of a human capital earnings model.[56] But what of other tests on the credentialists hypothesis? Psacharopoulos[57] rejects the credentialist hypothesis on the grounds that the rates of return to dropouts are as high as the returns to those who have completed courses, that earnings differentials standardized for non-educational factors continue to rise with age between educational cohorts even though employers have better information on employee abilities, and that screening could be done more cheaply by simpler testing procedures.

In the section following this, it is hoped that the impression is given of an on going debate on the validity of the human capital earnings model, as this seems to be an as yet unresolved issue in economics. Almost a decade after the Taubman-Wales type hypothesis we still have researchers such as

Medoff and Abraham[58] posing the question, "Are those paid more really more productive? The case of experience." In their analysis, using, in a major U.S. corporation, the supervisor's ratings of their subordinates as a proxy for relative productivity, they conclude that "performance plays a substantially smaller role in explaining cross-sectional experience-earnings differentials and economic growth than is claimed by those who have adopted the human capital explanation of the experience - earnings profile."[59]

(b) THE 'SUPPLY' SIDE CREDENTIALIST ATTACK - THE PUBLIC SECTOR IN DEVELOPING COUNTRIES[60]

The supply side credentialist attack on the human capital earnings model arises out of the observation that in developing countries the bulk of educated labour is in the employment of the public sector and that it therefore seems to be paying "itself" the high relative wages it gets. We use figures 2.7.a and 2.7.b below, to present the argument.



Private Employment (short run)

Figure 2.7.a

Public Employment (short run)

Figure 2.7.b

In the skilled labour markets depicted by figures 2.7.a and 2.7.b above, the supply of skilled labour is fixed ($ON_1 + ON_2$) up to, say, wage W_3, where perhaps foreign labour would be attracted into the economy. The marginal revenue product of labour, by the diminishing returns hypothesis referred to earlier (for figure 2.6), declines in both the private and public employment markets.

Again, using the profit maximization principle, we have that given inital labour supply N_1 in the private sector, that the optimum wage is OW_1, but that given initial labour supply N_2 in the public sector, that the optimum wage is OW_2. Clearly, if market forces were allowed free operation, a single uniform wage (between OW_1 and OW_2) would be established at which both markets were in profit maximization equilibrium. However, the "supply side credentialist's" contention is that this does not happen because the public sector also actually pays OW_1 which exceeds the MRP_L and implies that the public sector is over-employing $N_1^1 N_2$ labour. They argue that this situation is maintained as a consequence of the exceptional power educated civil service employees have over their own earnings and employment conditions in certain developing economies.

Thus we have another situation in which the credentials provided by the acquisition of education provide a passport to earnings which exceed the value of the marginal productivity of labour. In this case however, the degree of labour market imperfection is a function of the power of the educated employees in the public service to determine their own salaries. The applicability of the case seems to be restricted to developing countries however, where, by virtue of the smallness of the

private sector, it's pay scales are determined by those in the public sector rather than the other way around.

(III) RETURNS TO EDUCATION - THE DEBATE CONTINUES

In the preceding section two ways of explaining the role of education in determining the life-cycle of earnings were presented - the human capital approach and the credentialist approach. The basic hypothesis of the human capital theorists is that education, like health and job opportunity information, could be viewed as investment rather than consumption, whether motivated by the individual or by society on behalf of its members. In support of the hypothesis has come a mass of empirical work which has centred on the regression of earnings functions. The result of this research has largely been to confirm that education does play a significant role in determining earnings over the individuals working life, even after standardization for ability and socioeconomic backround factors. The rival thesis, that of the credentialists, explains the same basic empirical results, but shies away from the precise productivity perception implicit in human capital theory, in favour of models which explain earnings on the basis of the information about the individual, signalled by educational qualifications. Theorists supporting this thesis argue that it (the rival thesis) arises out of the uncertainty and inadequacy of information on the attributes of job applicants experienced by the employers - a situation which the job applicant seeks to overcome by presenting his credentials of which education is one of the most important and open to alteration. As a result of this, job opportunities become segmented on the basis of educational attainment - those with education enjoying higher rewards than those without and the most commonly cited reason for this is that education enables access to higher productivity jobs and careers. Thus credentialism is sometimes referred to as the labour market segmentation hypothesis. One's intuitive feeling is that the extreme viewpoints which often mark the debate, fail to appreciate

that both theories may have some validity. The credentialist hypothesis certainly seems to be a very feasible explanation for the initial earnings achieved by labour, but one would reasonably expect that over time the employer would get to know his employees better and make salary adjustments more in line with the employees productivity, as argued by the human capital theorists.

In this section, the 'first' debate we consider is the above-mentioned one, namely, the human capital theory versus credentialist debate where a few other perspectives are considered. However, it should be emphasised that the above mentioned debate is not the only one currently relevant in respect of the subject, returns to education. Of considerable interest also, have been the errors inherent in using earnings to calculate the returns on education. Thus,in the second part of this section we consider some of these errors and the implications of these for CBA applied to education. Finally, attention is drawn to the ongoing debate of trends on the rate of return to education. These trends have the potential to be of fundamental importance to decision making in the planning of education, but because of the many theoretical disagreements and the use of different data, considerable disagreement remains on these trends. Do we conclude then, that social rate-of-return analysis is something of a fanciful intellectual exercise, to be ignored as at present, in education planning? Certainly social rates of return need to be qualified,but considering the contemporariness of the debate and the tentativeness with which any empirical work in the field of economics is subject to, the present status of the analysis (in terms of the use made of it in education planning) does seem a little unjustified.

(i) OTHER NOVEL PERSPECTIVES ON THE HUMAN CAPITAL THEORY VERSUS CREDENTIALIST DEBATE

In this section three perspectives are considered - the awareness by those being educated of the earnings potential offered by

undertaking education, explaining the positive correlation over time between education and experience and a Marxian critique.

(i.1) THE AWARENESS BY THOSE BEING EDUCATED OF THE EARNINGS POTENTIAL OFFERED BY UNDERTAKING EDUCATION (THE DEMAND FOR EDUCATION)

If it is to make any sense treating education as an investment, then it must be assumed that those making the investment have some perception of the return on their expenditure. The case would appear to rest on evidence of whether the students or the parents making the decisions for those students, do in fact take account of expected lifetime earnings in their demand for education. Unfortunately however, the evidence is not of much consequence in terms of the human capital versus credentialist debate as both theories are orientated to explaining the same evidence.

In a recent study McMahon and Wagner[61] found that students at the higher education level do have 'quite' realistic education-age-earnings expectations and that enrollment patterns correspond reasonably well with expected starting salaries in the different labour market segments. Their study is however, too limited to generalize about the demand for education and is not sufficient for a general rejection of the Marshallian stance that students lack the necessary information and have unreliable expectations. There still remains considerable divergence of views on this matter, however. For example, in a very recent study Psacharopoulos and Sanyal[62] found that graduates in Egypt had expectations of the labour market in tune with actual labour market conditions, whereas Freiden and Staaf[63] using student changes accross subject majors, explained the student choice in terms of a consumption theoretical framework rather than a human capital one. (Their data related to information gathered at the

University of Delaware, USA). Again, on the other hand, Mingat and Eicher[64] explaing this phenomenon (subject changes) in a case study in France, argue that it does not require the abandonment of the human capital investment model, it merely requires that student academic and social backround along with his attitudes towards the risk of failure in the higher return but more difficult discipline options, be integrated into this model.

Essentially however, even if it could be showed that there was a general investment demand for education (as against consumption demand), the consequences in terms of the human capital versus credentialist debate are minimal. Even if private individuals were aware of the earnings opportunities offered by different segments of the labour market, this in no way undermines the rival thesis of credentialism. The reason for this is that credentialism is not founded on the lack of earnings perceptions but on the lack of productivity perceptions. The decision on which of the two theories one favours must ultimately be made on the basis of the employers expected productivity perceptions, or lack of them, in determining wages.

The rival theories compete on the same empirical basis, and it is against this backround that Mc Nabb and Psacharopoulos (in frustration) remark, "empirical analysis of the dual labour market hypothesis has been hampered by the failure of its proponents to develop a model of the labour market that provides testable hypotheses that distinguish it from the orthodox approach".[65]

(1.2) EXPLAINING THE POSITIVE CORRELATION BETWEEN EDUCATION AND EXPERIENCE

A fairly universal result emerging out of earnings function analysis, has been the tendency, (in addition to earnings being positively correlated with education

and experience) "for the coefficient of education to depend on the length of employment experience".[66] This runs slightly contrary to the Mincerian human capital model presented earlier in this chapter to explain the life-cycle of earnings, in that we would expect, by the operation of depreciation on human capital over time, that returns to education would decrease with increasing experience. However, the phenomenon can be accomodated in the human capital approach by incorporating acquired education into the human capital production function, as done in the Ben-Porath model. By this incorporation we expect increasing educational 'production' from investments over time and thus can account for the positive correlation between education and experience.

By the credentialist hypothesis we might also find this correlation slightly incongruous, as we would expect that as employers get to know their employees over time, that they would rely less on their educational credentials and more on their productivity perception (although some may argue that this always remains very hazy). However, by the segregated labour market hypothesis, credentialism is also able to accomodate this correlation. The segregated labour market theory implied that job promotion ladders and associated wage scales (including the starting wage) were different for differently educated groups which is quite compatible with the positive correlation described. The problem with this is that it seems to deny an economic rationale for the wage structure in that it suggests that it is an exogeneously determined factor in the analysis. Why then, does it turn out the way it does?

Knight and Sabot[67] have offered a "filtering down" theory which they claim draws on both human capital theory and credentialism in explaining the correlation between education and labour experience. A key note to their theory lies in their interpretation of the labour

experience variable in the earnings function. Not only does this describe actual work experience - it also classifies when a worker enters the labour force. Using this classificational interpretation of the experience variable, they argue that differences in the coefficient to education for different labour 'experience' groups could merely reflect changed labour market conditions over time. Thus they interpret the increasing returns to education with experience as reflecting decreasing returns to education for successive cohorts of entrants into particular types of employment. The lower returns to education of the later cohort employment entrants, they attribute to the increasing supply of educated persons. Following a segmented hypothesis, they argue that this increased supply has led to a "filtering down" of highly educated to occupations which previously utilized less highly educated labour. The reason why the earlier cohorts are argued to be less susceptible to this supply pressure is that the market adjustment of the occupational structure of wages is said to operate with a lag. As earlier cohorts are not directly in competition with later cohorts due to their being at different stages in the job ladder, only the later cohort entrants are "filtered down." The "filtering down" theory does offer a partial explanation of the dynamism of the wage structure, i.e. a lagged supply 'operator', given demand, but the problem with the theory is that it neglects the demand determining factors in explaining the wage structure - a perspective which is perhaps highlighted by the Marxian critique of human capital theory.

(i.3) A MARXIAN CRITIQUE - BOWLES AND GINTIS[68]

The fundamental marxist critique is that,

> "by restricting its analysis to the interaction of exogeneously given individual preferences, raw materials (individual abilities) and alternative

> production technologies, human capital theory excludes the relevance of class and class conflict to the explication of labour market phenomena". 69

(One could add the same about credentialist theory). Marxists define capitalism as a situation where the masses are forced to sell their labour (in order to subsist) to a small minority of capitalists who control the means of production and use their institutional power to perpetuate this economic and social order. The Marxists insist that the wage structure cannot be exogenenous, or be interpreted as a pure exchange of wages for labour given. Their reason is that this analysis ignores the power of the capitalist over the workers. Capitalists desire to extract maximum labour from workers at minimum wages in order to maximize the surplus product of labour, and the social structures instituted in a capitalist system should be seen as manifestations of this objective in terms of Marxian analysis. Thus they perceive race, sex, age, ethnicity and education as attributes used by capitalists to fragment the labour force and thus reduce the potential formation of harmful labour coalitions. Although it may seem, that paying educated labour more, runs contrary to the capitalists surplus maximization intentions, this need not be so. It may be worth more in terms of the overall impact on the wage bill to pay the educated labour more, for the divisions in the labour force which this creates. (Of course besides this, if education does increase productivity it also permits greater potential surplus value extraction.) Going even one step further, allowing for education itself being determined by capitalists through their influence over governmental policy, they suggest by developing workers compitable to the capitalist system, education may in fact have become essential to reproducing the capitalist structure.

It should be clear from the above discussion that the Marxist interpretation of the various rates of return to

schooling do not rely on productivity. Education is one of the means by which the capitalists are able to fragment the labour force. They do this by paying educated labour more than the others - the extent of this excess reflecting the power (and potential) a group of workers is likely to have over the other workers. Thus, the less power threat of the worker sgements the less they would be paid, irrespective of productivity. Citing the comparatively low returns achieved on education by Black females, they argue this reflects the lack of authority of this group over the other working class members in general.[70] To expect equality in the rates of returns to education (after allowing for differences in risk) on the basis of optimization of investments, as suggested in the Mincerian analysis, is bound to conflict with the realities of the situation, by their analysis. Different segments within the educated labour market will have different power valuations by the capitalists and will thus be paid different wages. A wage structure which coincidentally ties in with human capital or credentialist theories has emerged, but the essential inadequacy of these theories (according to the Marxian critique) is that they fail to explain why the wage structure emerged in this way at all.

From the CBA application to education point of view, the Marxist analysis is of greatest significance to the calculation of the social rates of return to education which, in terms of their analysis, would cease to have any investment meaning. The position taken here by the Marxists is extreme however, and one is also left feeling that it is slightly mythological in the sense that their class 'characters' are more historical than present day phenomena-capitalist and worker elements are not always readily distinguishable in present day 'capitalist' economies.

(ii) THE DEBATE ON THE ERRORS OF USING EARNINGS VARIATION TO REFLECT THE BENEFIT OF EDUCATION - IMPLICATIONS FOR CBA APPLIED TO EDUCATION

In chapter 1 we gave considerable coverage to explaining the implications of using market prices in CBA and most of this discussion is directly relevant to education, eg. the use of shadow pricing in the estimation of the direct social costs of education, the externality-publicness components of education, the scarcity constraints on the ability of society to provide education, welfare, risk and uncertainty considerations in educational expenditure, the interpretation of the rate of return to education against the perspective of the dual functions of the discount rate and the failure of CBA to accommodate non-quantifiable benefits from and costs of education in its calculus. But there remain over and above the items already covered, certain particular debates, relevant to the use of earnings as a measure of costs and benefits in a CBA applied to education, which deserve further elaboration.

We assume in an 'unadjusted' human capital approach to earnings variation, that inter alia, working hours do not vary between education cohorts, that there exists a certain homogeneity in the quality of educational 'exposure' and that ability and socioeconomic status (SES) factors are inconsequencial. It seems permissible to ignore the first mentioned phenomenon but the latter two have provoked considerable discussion. Consideration of the quality of schooling on its own seems to have emerged as a fairly recent phenomenon and clearly much research remains to be done. Perhaps however, quality of schooling is so closely tied to one of the other mentioned factors, namely SES, that the separate consideration of the quality of schooling does really remain unnecessary - we would expect SES to reflect the intellectual and financial support provided during schooling, and therefore incorporate quality of schooling. But while arguing this to be the case, we could note that a more direct consideration of the impact of SES relates to a situation where

the individual's access to higher paid jobs makes education necessary but is not sufficient for this.[71] In such a case, the separate consideration of quality of schooling and SES may be required.

The variables often taken to represent SES are the father's occupation, the mother's education and place of residence - definitely superior to the common measure for ability, namely IQ, where the representativeness of this variable for what it is supposed to measure is questionable because IQ measures a very narrow range of abilities. But while this problem is a part of the debate on the question of whether ability and SES account for part of the earnings variation which may otherwise erroneously be attributed to education, it is not essential to the debate - there have been refinements and variations on IQ as a proxy for ability, and even in using IQ some interesting perspectives have emerged. Using Welch's [72] analysis of various studies as a basis, some data on the issue is presented in the following tables.

TABLE 1

DEFLATION OF SCHOOLING COEFFICIENTS FOR SES

NAME OF RESEARCHERS	% REDUCTION
J. Morgan and M. David[73]	12%
A. Leibowitz[74]	0%
S. Bowles[75]	40%

TABLE 2

DEFLATIONS OF SCHOOLING COEFFICIENTS FOR ABILITY

NAME OF RESEARCHERS	% REDUCTION
H. Gintis[76] (9 studies)	4-35% (average 10%)
E. Hanushek [77]	15%
P. Taubman and T. Wales[78] (general ability)	9%
P. Taubman and T. Wales[79] (mathematical ability)	30-35%
Z. Griliches and M. Masson[80] (initial testing)	7-10%
Z. Griliches and M. Masson[81] (post school testing)	13-17%

It would seem then, that ability and SES should be accounted for in earnings before one attributes the variations in earnings purely to education. Virtually all researchers reveal a significant correlation between ability and earnings, and between SES and earnings. The overall deflation factor of the contribution of schooling to earnings as measured from earnings variation consists of the addition of these two deflation indices - the percentage discount suggested, being commonly termed the alpha (α) factor. There is little point in averaging out or making maximum and minimum observations on the basis of the research results summarised above - drawing conclusions by this method about the α factor would require a far more comprehensive study. But, if we did choose to draw some conclusions from the tables above, perhaps the central tendency emerging from H.Gintis's summary of nine different studies and the findings of J. Morgan and M. David would serve as the best medians for the ability and SES deflating of earnings variations respectively. On this basis we could

possibly conclude that the a deflation factor should lie at around the 22% level.

(iii) THE DEBATE ON TRENDS IN THE RATE OF RETURN TO EDUCATION

In 1975 Freeman[82] asserted that the social rate of return on investment in U.S. college education for males, although increasing from 10,5% in 1959 to 11,1% in 1969, had since then, rapidly declined to 9,5% in 1972 and 7,5% in 1974. Witmer,[83] using different data, has contested this finding. Witmer found that the social rate of return on U.S. college education rose from 14,2% in 1961 to 15,1% in 1975 and that the lowest annual rate of return over the intervening years was calculated for 1968, when it was estimated at 13,1%. Freeman in turn has rejected these findings arguing,

> "Witmer is not basing his calculations on actual incomes, as I and other analysts have done, but on his own undocumented forecasts".[84]

This type of exchange is not a new phenomenon in the economic journals.[85] The calculation of social rates of return to education is really the last step in the analysis and it is necessarily preceeded by a great many subjective assumptions. It comes as no surprise then, that there should be a debate of this nature. But one cannot help feeling that there are hazzards in the debate - conclusion that the concept of a social rate of return to education is an interesting intellectual abstraction but unfortunately of little practical use, is tempting, and a perspective which is held by many with respect to CBA applications in general (see chapter 1 - evaluation). But as with chapter 1, it is felt that this conclusion is too extreme - the application of CBA from both the private and social angles does offer the potential for fruitful guiding criterion to the relevant decision makers. Perhaps human capital theory does not provide the 'safest' of theoretical backrounds against which to do this, (which is not really surprising in view of the relative contemporariness of the topic), but the contentiousness

of the human capital research program is not sufficient alone to motivate for its complete abandonment. What it does imply, is the necessity for thorough qualification of the rate-of-return results and the investigation of the possibilities for analytical approaches which can be used to complement rate-of-return criterion in decision making.

(IV) REFERENCES

1. Smith, A. An inquiry into the nature and causes of the wealth of nations, Volume I, London, Methuen, 1904, p. 103.

2. Blaug, M. An introduction to the economics of education. London, Penguin, 1972, p. 1-8.

3. Fisher, I. The nature of capital and income. New York, MacMillan, 1923, p. 51-65.

4. Marshall, A. Principles of economics: An introductory volume, (Eighth Edition). London, MacMillan, 1959, p. 647-651.

5. Marshall, A. op.cit., p. 650.

6. Marshall, A. op.cit., p. 475.

7. Marshall, A. op.cit., p. 470.

8. Becker, G.S. Human capital: A theoretical and empirical analysis with special reference to education. New York, National Bureau of Economic Research, 1964.

9. Kiker, B.F. "Historical roots of the concept of human capital", Journal of Political Economy, Volume 74, Number 5, 1966, p. 481.

10. Kiker, B.F. "Marshall on human capital: Comment", Journal of Political Economy, Volume 76, September, 1968, p. 1088-1090.

11. Bates, T. Aspects of the theory of human capital and its application to South African economic development. Unpublished Masters Dissertation, Rhodes University, 1973, p. 4-15.

12. Bowman, M.J. "The human investment revolution in economic thought", Sociology of Education, Volume 39, 1966, p. 111-138. Also in, Economics of education 1. (Edited by Blaug, M.) London, Penguin, 1971, p. 101-134.

13. Bowman, M.J. op.cit., p. 108.

14. Bowman, M.J. op.cit., p. 108.

15. Denison, E.F. The sources of economic growth in the United States and the alternatives before us. New York, Committee for Economic Development, January, 1962.

16. Denison, E.F. op.cit., p. 67-89.

17. Schultz, T.W. "Investment in human capital", American Economic Review, Volume 51, 1961, p. 1-17. Also in, Economics of education 1. (Edited by Blaug, M.) London, Penguin, 1971, p. 13-33.

18. Horvat, B. "The optimum rate of investment", Economic Journal, Volume 68, December, 1958, P. 747-767.

19. Horvat, B. op.cit., p. 748.

20. Horvat, B. op.cit., p. 761.

21. Blaug, M. (Editor). Economics of education 1. London, Penguin, 1971, p. 11.

22. Bowman, M.J. ibid.

23. de Lange, J.P. (Commission). Provision of education in the RSA Report of the Main Committee of the HSRC Investigation into Education, 1981, p. 1.

24. Blaug, M. An introduction to the economics of education. London, Penguin, 1972, p. 24-25.

25. Becker, G.S. op.cit.

26. Blaug, M. "The empirical status of human capital theory: A slightly jaundiced survey", Journal of Economic Literature, Volume 14, Number 3, September, 1976, p. 828.

27. Denison, E.F. op.cit. p. 1-14 and 67-89.

28. Becker, G.S. op.cit. p. 80-88.

29. Blaug, M. An introduction to the economics of education. London, Penguin, 1972, p. 102.

30. Ninth Economic Development Programme for the Republic of South Africa. 1978-1987. A strategy for growth. Volume I, Pretoria, Office of the economic advisor to the prime minister, 1979, p. 92-115.

31. Blaug, M. op.cit., p. 165.

32. Psacharopoulos, G. "Returns to education: An updated international comparison", Education and Income, World Bank Staff Working Paper, July, 1980, p. 76.

33. Becker, G.S. op.cit.

34. Mincer, J. Schooling, experience and earnings. New York, National Bureau of Economic Research, 1974.

35. Ben-Porath, Y. "The production of human capital and the life cycle of earnings", Journal of Political Economy, Volume 75, August, 1967, p. 352-365.

36. Becker, G.S. op.cit.

37. Blaug, M. op.cit., p. 191.

38. Mincer, J. op.cit.

39. Eckaus, R.S. "Investment in human capital: A comment", Journal of Political Economy, Volume 71, Number 5, 1963, p. 501-505.

40. Eckaus, R.S. op.cit., p. 503.

41. Mincer, J. op.cit.

42. Mincer, J. op.cit., p. 130.

43. Psacharopoulos, G. and Layard, R. "Human capital and earnings: British evidence and a critique", Review of Economic Studies, Volume 46, Number 144, July, 1979, p. 485-503.

44. Mincer, J. op.cit.

45. Psahcaropoulos, G. and Layard, R., op.cit., p. 488.

46. Psacharopoulos, G. and Layard, R. op.cit.,p. 489.

47. Psacharopoulos, G. and Layard, R. op.cit.,p. 485-486.

48. Ben-Porath, Y. op.cit.

49. Ben-Porath, Y. op.cit., p. 357.

50. Ben-Porath, Y. op.cit., p. 359.

51. Blaug, M. op.cit., p. 205.

52. Layard, R. and Psacharopoulos, G. "The screening hypothesis and returns to education", Journal of Political Economy, Volume 82, 1974, p. 985-998.

53. Spence, M. "Job Market signalling", Quarterly Journal of Economics, Volume 87, 1973, p.353-374.

54. Taubman, P.J. and Wales, T.J. "Higher education, mental ability and screening", Journal of Political Economy, Volume 81, 1973, p. 28-55.

55. Layard, R. and Psacharopoulos, G. op.cit.

56. Taubman, P.J. and Wales, T.J. op.cit., p. 47-50.

57. Layard, R. and Psacharopoulos, G. op.cit.

58. Medoff, J.L. and Abraham, K.G. "Are those paid more really more productive? The case of experience", Journal of Human Resources, Volume XVI, Number 2, 1981, p. 186-216.

59. Blaug, M. op.cit. p. 186.

60. Blaug, M. op.cit., p. 205-212.

61. McMahon, W.W. and Wagner, A.P. "Expected returns to investment in higher education", Journal of Human Resources, Volume 16, Number 2, May, 1981, p. 274-285.

62. Psacharopoulos, G. and Sanyal, B. "Student ecpectations and graduate market performance in Egypt", Higher Education, Volume 11, Number 1, January 1982, p. 27-50.

63. Freiden, A.N. and Staaf, R.J. "Scholastic choice: An economic model of student behaviour", Journal of Human Resources, Volume 8, Number 3, 1973, p. 396-404.

64. Mingat, A. and Eicher, J.C. "Higher education and employment markets in France", Higher Education, Volume 11, Number 2, March, 1982, p. 211-220.

65. Mc Nabb, R. and Psacharopoulos, G. "Further evidence on the relevance of the dual labour market hypothesis for the U.K. "Journal of Human Resources, Volume 16, Number 3, 1981, p. 443.

66. Knight, J.B. and Sabot, R.H. "The returns to education: Increasing with experience or decreasing with expansion?", Oxford Bulletin of Economics and Statistics, Volume 43, Number 1, February, 1981, p. 51.

67. Knight, J.B. and Sabot, R.H. op.cit., p. 51-71.

68. Bowles, S. and Gintis, H. "The problem with human capital theory - A Marxian critique", American Economic Review, Volume 65, May, 1975, p. 74-82.

69. Bowles, S. and Gintis, H. op.cit., p. 74.

70. Bowles, S. and Gintis, H. op.cit., p. 80.

71. Welch, F. "The human capital approach: An appraisal: Human capital theory, discrimination and life cycles", American Economic Review, Volume 65, May, 1975, p. 63-73.

72. Welch, F. ibid.

73. Morgan, J. and David, M. "Education and income", Quarterly Journal of Economics, Volume 77, August, 1963, p. 423-437.

74. Leibowitz, A. "Home investment in children", Journal of Political Economy, Volume 82, March, 1974, p. 111-131.

75. Bowles, S. "Schooling and inequality from generation to generation", Journal of Political Economy, Volume 80, March, 1972, p. 219-251.

76. Gintis, H. "Education technology and the characteristics of worker productivity", American Economic Review, Volume 61, May, 1971, p. 266-279.

77. Hanushek, E. "Regional differences in the structure of earnings", Review of Economics and Statistics, Volume 55, May, 1973, p. 204-213.

78. Taubman, P.J. and Wales, T.J. Higher education and earnings. New York,

79. Taubman, P.J. and Wales, T.J. ibid.

80. Griliches, Z. and Masson, M. "Education, income and ability", Journal of Political Economy, Volume 80, March, 1972, p. 74-103.

81. Griliches, Z. and Masson, M. ibid.

82. Freeman, R.B."Over-investment in college training?", Journal of Human Resources, Volume 10, 1975, p. 287-311.

83. Witmer, D.R. "Has the golden age of American higher education come to an abrupt end?", Journal of Human Resources, Volume 15, Number 1, 1980, p. 113-120.

84. Freeman, R.B. "The facts about the declining economic value of college", Journal of Human Resources, Volume 15, Number 1, 1980, p. 139.

85. The "exchange" referred to is published in the Journal of Human Resources, Volume 15, 1980.

CHAPTER 3

CBA IN BLACK EDUCATION IN SOUTH AFRICA

(I) THE INTERNATIONAL STUDIES BACKGROUND

CBA in South Africa can usefully be reviewed against the background of studies done of this nature in other countries. In this section we examine the results of a few significant surveys of these studies with a view to providing some perspective for the subsequent analysis of Black education in South Africa, and also to provide background to some aspects of the model presented in Chapter 4. Psacharopoulos's "Returns to Education: An International Comparison"[1] is the central reference of this section, although his later updating[2], the surveys of the 1980 World Development Report on Education[3] and Lockheed, et. al. "Farm Education and Farm Efficiency: A Survey", are also referred to.

(i) PSACHAROPOULOS'S RETURNS TO EDUCATION: SOME FINDINGS[5]

Psacharopoulos insists that, "the cornerstone of practically any analysis in the economics of education is the relationship between benefits and costs associated with different levels of schooling",[6] and that regardless of the consumption component of education, treating education as an investment enables us to determine its private and social pay off. He is, needless to say, of the human capital school. The data he uses relates to CBA estimations but he does acknowledge, in an updating article,[7] that the Mincerian earnings function approach to rate-of-return estimation has gained increasing popularity. Note that the studies used, although predominantly published between 1964 and 1973, relate to data spanning a considerably larger time.

The first question to which Psacharopoulos addressed himself was a comparison of the internal rate of return (IRR) to education with the IRR to physical capital. (The preferential use of IRR over other NPV criterion relates to its ready comparability with other rates of return - see chapter 1 section II(IV.4)).

Using per capita income as an index of the level of a country's development, (a less developed country is generally taken to have a per capita income of less than £1000 in Psacharopoulos's international comparisons), he found that the rates of return to physical and human capital, averaged internationally, were as is tabled below.[8]

TABLE 3

LEVEL OF DEVELOPMENT (Per Capita income)	RATE OF RETURN ON PHYSICAL CAPITAL (% p.a.)	RATE OF RETURN ON HUMAN CAPITAL (Average private IRR; % p.a.)
Less than £1000 (7 countries)	15,1	19,9
Greater than £1000 (6 countries)	10,5	8,3

Thus the return of human capital only exceeded that on physical capital on average, for the less developed countries (L DC's). In respect of the above rates it is perhaps worth noting though, (a) that the comparability of the IRR is severely restricted by virtue of the dual function of the discount rate (see Chapter 1, section II (IV.1)), and (b) that the return on physical capital, which was calculated from the percentage of average net book income to the average net asset value, is not strictly comparable to IRR, which was derived from discounted cash flows.

A second question to which Psacharopoulos addressed himself, was the contribution made by investment in education to economic growth. He distinguishes two ways of incorporating education into growth accounting calculations, a 'Schultz' way and a 'Denison' way.[9] Letting Y be National output, K capital, L labour, D land, MP the marginal product (of the relevant subscripted factor), t time, I investment (i.e. $\frac{dK}{dt}$), k the investment

(capital) to output ratio, S labour's share of total output and g, a growth symbol (of that which is indicated by the subscript), it follows, that if output is a linear function of capital land and labour in

$$Y = f(K, L, D)$$

, then $\frac{dY}{dt} = \frac{dK}{dt} MP_k + \frac{dL}{dt} MP_L + \frac{dD}{dt} MP_D$, which, where $\frac{dD}{dt} = 0$ becomes, $\frac{dY}{dt} = \frac{dK}{dt} MP_k + \frac{dL}{dt} MP_L$.

Dividing through by Y and making the appropriate substitutions we obtain the basic growth equation,

$$g_y = k\, MP_k + g_L\, S_L \quad \ldots\ldots\ldots \qquad (3.01).$$

By 'Schultz's' method we divide capital, in this function, into material capital (M) and human capital (H). Thus the 'Schultz equation' is given by

$$g_y = k_M\, MP_M + k_H\, MP_H + g_L\, S_L \quad \ldots\ldots\ldots \qquad (3.02)$$

, where L represents 'raw' uneducated labour. If in equation 3.02, we now make the approximations $r_H = MP_H$ and $r_M = MP_M$, where r stands for the relevant social rate of return, we obtain,

$$g_y = k_M\, r_M + k_H\, r_H + g_L\, S_L \quad \ldots\ldots\ldots \qquad (3.03),$$

and it follows that the contribution made by education to growth, using the 'Schultz equation' (3.03), is $k_H\, r_H$. This can be disaggregated further to measure the contribution to growth by level of schooling if desired.

Using this method, the average contributions to economic growth of the relative levels of education were 46%, 40% and 14% for primary, secondary and higher education respectively.[10] Psacharopoulos does qualify these results however, suggesting that because foregone earnings were included in I_H but not in Y, and because not all the educated persons participated in the labour force, resulting in I_H being overstated, that k_H was excessive and hence that the contributions were likely to have been over-estimates.

The 'Denison-type growth equation' is derived by distinguishing different types of labour in equation 3.01, i.e.

$$g_y = k\ MP + \sum_{i=0}^{n} g_{Li}\ S_{Li} \quad \ldots\ldots\ldots \quad (3.04)$$

, where n is the number of years of education. The contribution of education to output growth by equation (3.04) is measured by $g_{Li}\ S_{Li}$. Using Denison's calculations for the U.S., covering the period 1929-1957, g_y = 2,93% p.a., g_{Li} due to the improved educational composition of the labour force equal to ,93% p.a. and $S_{Li} = \frac{73}{100}$. Thus, of the 2,93% p.a. growth of national income in the U.S. ,68% p.a. or 23% of the growth is directly accounted for by the expansion of education.

Perhaps the most important 'international' result to emerge out of the Psacharopoulos survey in respect of growth is that the contribution of education to growth decreases as economic development increases.[12]

A third question to which Psacharopoulos addressed himself was that of which level of education produced the highest IRR. The following averages were calculated.[13]

TABLE 4

NATURE OF THE IRR	PRIMARY (%p.a.)	SECONDARY (%p.a.)	HIGHER (%p.a.)
Private	23,7	16,3	17,5
Social	19,4	13,5	11,4

Other findings were that differences in rates were more pro - nounced in L DC's and that the average return on education for females was approximately 2% less in higher and secondary education, and approximately 6,5% less in primary education than it was for males. In an updating article on returns to education,[14] he reaffirms that primary education yields substantially greater returns on educational expenditure than either secondary or higher education.

Another area which was examined in his survey was the nature of cost and earnings differentials between education levels and between countries at different levels of advancement. His findings, are presented in table 5 below.[15]

TABLE 5

Development level	Cost 1 year higher education as a ratio to cost 1 year primary education	Foregone earnings for higher education as a percentage of total cost	Graduate earnings as a ratio to primary educated worker
LDC	$\frac{88}{1}$	34%	$\frac{6,5}{1}$
Developed country	$\frac{18}{1}$	53%	$\frac{2,5}{1}$

Of interest here, is the massive difference in the cost of higher and primary education and the tendency for earnings differentials to decrease the more advanced the country is.

Another question which Psacharopoulos attempted to shed light on, was that of the relationship between income levels and returns to education. His international comparison suggested a relationship of the nature depicted in figure 3.1 below.[16]

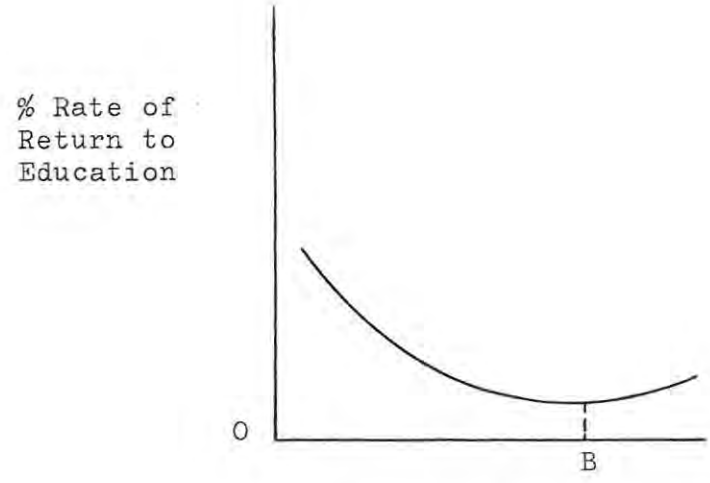


Figure 3.1

From figure 3.1 it may be seen that up until an annual per capita income of B, ($\pm$ £ 1000), countries experience declining average rates of return to education with increasing annual per capita income, but that above this level it would appear that they begin to increase, This is an interesting result and has considerable relevance to educational planners who might wish to obtain some insights to future trends from the experience of other countries, but it is not easily explained. Psacharopoulos suggests that it is a consequence of the complementary nature of education and high levels of technological development, but it is difficult to see why this should only begin to have effect at the £ 1000 average annual per capita income mark.

One of the interesting uses that Psacharopoulos puts higher education rates of return to, is in explaining the 'brain drain' phenomenon - the expectation being that the direction of the 'brain drain' would be towards the highest rate of return opportunities. Psacharopoulos tested this hypothesis by comparing cross rates of return on education of other countries to the USA and relating this with migration figures. Although this was not a conclusive test in that;(a) there were a small number of observations on which the test was based, (b) that migration figures instead of applicants for US visas, which would have been more accurate, were used, and (c) that there was little recognition given of the differing education status of different emigrants; it offered a 'better' statistical explanation for migration than the 'conventional' standard of living differentials or accessability in terms of distance to travel.[17]

(ii) THE WORLD DEVELOPMENT REPORT ON EDUCATION: SOME FINDINGS[18]

The relatively high rates of return to primary education are confirmed in this report, as seen in table 6 below, where the average social rates of return of numerous studies over the period 1957 - 1978 are summarised.[19]

TABLE 6

COUNTRY GROUP	PRIMARY (% p.a.)	SECONDARY (% p.a.)	HIGHER (%p.a.)	NUMBER OF COUNTRIES STUDIED
All developing countries	24,2	15,4	12,3	30
Low Income/ Adult Literacy Rate (under 50%)	27,3	12,2	12,1	11
Middle Income/ Adult Literacy Rate (over 50%)	22,2	14,3	12,4	19
Industrialized Countries	-	10,0	9,1	14

In the report the view is taken that these rates of return are a reflection of productivity increases. Education is argued to increase productivity through two effects-

(a) by the general increase in reasoning skills (cognitive effects), and

(b) by the change of beliefs and values (non-cognitive effects).

Note that the way that effect (b) increases productivity, is by making the individuals more receptive to new ideas, encouraging competitiveness and developing a more disciplined (goal directed) approach to work. A popular way of testing whether these effects do increase productivity has been to measure the increase in farming efficiency resulting from farm education. Lockheed, et.al [20] in a survey of 18 such studies came to the overall conclusion that farm productivity is increased by 74% as a result of a farmer undetaking four years of elementary education rather than none. (One could note in passing, that these findings run very contrary to the credentialist's point of view and imply that the credentialist approach is not well suited to all spheres of production-farming being a notable exception)

The report also draws attention to the numerous non-economic objectives of education, from which one could imply that these may be of greater significance than are presently thought. The investment benefit of educating females (reduction in fertility and child mortality, improved family health care and advantageous influence over children) is particularly stressed. Also recognition is given to purely scientific, cultural and intellectual objectives of education. It is clear from an education planning perspective, that the economic dimensions of education are but one of many, and should not be overplayed. One could make allowance for this in a decision making framework - an all inclusive 'impact matrix' being a possible theoretical framework for incorporating these considerations (see Chapter 4).

The report also offers some interesting perspectives on the education of the poor - considerations which are of particular relevance to the provision of education for Blacks in South Africa. A particularly sensitive cost determining item in education is the pupil to teacher ratio - a common assertion being that a high pupil to teacher ratio reduces the quality of schooling. Hence, the significance of the finding in the report that increasing the class size from 15 to 35 only reduces achievement by approximately 4%, increasing class size from 35 to 40 only reduces achievement by 1% and increases above this, do not seem to reduce achievement any further.[21] It seems astonishing in the light of the enormous financial significance of the pupil to teacher ratio, that the De Lange Commission[22], in its report on the provision of education did not choose to explore the precise educational impact of variations in this ratio. This is not to say that the measurement of educational achievement in the World Development Report is entirely satisfactory. Post 'lecture' tests on the work covered do not reflect important disparities in 'hidden curriculum' items (the transfer of teacher attitudes) arising out of pupil to teacher ratio variations. Clearly, much research is needed in this area.

Two particularly severe social problems which have emerged in attempts to educate the children of the poor have been

malnutrition and the attitudes of the parents. The report comments that some sort of compensatory programme may be necessary to complement formal schooling for this section of the population, eg. adult education and specially designed compensatory courses for the pupils. Of particular significance in this connection is the designing of a curriculum which takes account of the differing linguistic backrounds of the students. Extensive work on properly designed textbooks and radio supporting projects are recommended to support such a programme.

(iii) THE RELEVANCE OF THE INTERNATIONAL STUDIES BACKROUND TO THE APPLICATION OF CBA TO BLACK EDUCATION IN SOUTH AFRICA

Not much work has been done in the application of CBA to Black Education in South Africa and for this reason it is particularly important to complement the little that has been done with the findings which have emerged from international comparisons. In this section many of the uses to which rates of return to education may be put, have been explored. Some of the main findings to emerge were, the outstanding importance of primary school education, the favourable comparability of rates of return on human capital over that on physical capital in the less developed countries, an expectation of declining rates of return to education with economic growth (up to a point), a significant correlation between migration and cross-national rates of return to education, a significant link between education and farm productivity and the importance of the non-economic motivations for education. Against this background and bearing in mind the theoretical developments in the fields of CBA and human capital theory (chapters 1 and 2), a few perspectives are now considered in the application of CBA to Black education in South Africa.

(II) A REVIEW OF WORK DONE IN THIS FIELD

(i) INTRODUCTION

There has not been a great deal of research done in the field of determining rates of return to Black education in South Africa. The only comprehensive study along this line would appear to be that done by Louw[23], who used an earnings function approach to achieve this end. No major CBA application to Black education in South Africa would appear to have been done, although Smuts and Terblanche[24] have applied the technique to Asian, Coloured and White education. Interestingly Joubert[25], drawing his data from the same census series, and for the same population groups but using an earnings function approach to rate-of-return estimation, arrives at vastly different figures to those determined by Smuts and Terblanche. As the main considerations in this thesis are CBA and Black education, the studies of primary interest in this section are the former two, namely the Smuts/Terblanche and the Louw studies.

The main difficulty in conducting a CBA study in respect of Black education in South Africa has been that of acquiring sufficient primary data. In the 1960 and 1970 censuses, education and earnings information was asked of the Asians, Coloureds and Whites but not of the Blacks; and in respect of the 1980 census, although all population groups were asked for education and earnings information, detailed data has yet to be published. The Smuts/Terblanche and Joubert studies used the material yielded by the 1960 and 1970 censuses to estimate rates of return to Asian, Coloured and White education.

As was mentioned in the introduction to the human capital backround of the application of CBA to education (Chapter 2 section (II.1)), there are alternative sources to censuses from which the required cross-sectional data may be acquired; for example, national and regional surveys. In South Africa, the surveys conducted in all the major urban areas by the Bureau

for Market Research[26] at the University of South Africa, are such that they could be used as in alternative source of data, although the data published from these surveys, are not immediately usable for this purpose. Louw using the the 1975 surveys, (presumably by having a computer programmed specially drawn up for the purpose), has managed to obtain data in order to estimate rates of return (by the earnings function approach) to Asian, Black and Coloured education.

Another potential source of data which can be used for rate of return to education estimations lies in company employee records. Bates[27] in a thesis published in 1973, for example, utilized African Explosives and Chemical Industries records in this respect to speculate about the possibilities of rate-of-return calculations using the CBA technique. However, the interpretation of rates of return calculated on this basis is very restricted because of the limits of the sample population.

A different type of data altogether which can be used for the purpose of CBA application to education is time series data, where the costs of education and earnings performance of individuals is kept over their lives. It would appear for South Africa that such data is only kept in respect of certain managment and professional groups of workers, (eg. MBA graduate schools) although such studies have been done in other parts of Africa. For example, Okedara[28] has attempted such a study in respect of a selected group of primary school children and members of an adult literacy programme in Ibadan, Nigeria. Adjusting earnings for expected growth rates, wastage (failure and dropouts), ability determinants and unemployment, he derives private and social rates of return to primary schooling and an adult literacy programme - the private and social rates of return relevant to primary schooling being 8% and 6% p.a. respectively and to the adult literacy programme being 15% and 12% respectively.[29]

In this section we concentrate on the results of the South African studies referred to above and make selected comments on some aspects of these studies.

(ii) SOME RESULTS

The marginal rates of return of education presented below for South Africa, as calculated by Smuts/Terblanche, Joubert and Louw, relate to males only and are private rates.

TABLE 7

Source of data	Educational Cohort	The Rates of Return (% p.a.)								
		Asians			Blacks			Coloureds		Whites
		1960	1970	1975	1975	1960	1970	1975	1960	1970
Smuts/Terblanche[30]	Sub A - Std 5	+100	+100	-	-	+100	+100	-	+100	+100
	Stds 6 - 7	+100	+100	-	-	+100	+100	-	+100	+100
	Std 8	48	42	-	-	55	42	-	+100	+100
	Std 9	33	34	-	-	36	32	-	+100	+100
	Std 10	31	28	-	-	32	28	-	59	55
	4 years higher education	22	22	-	-	25	20	-	27	29
Joubert[31]	Std 1	15	-	-	-	1	2	-	-	-
	Stds 2 - 6	6	7	-	-	9	7	-	18	10
	Stds 7 - 9	14	14	-	-	16	14	-	9	9
	Std 10	50	35	-	-	142	56	-	24	16
	+ Diploma	7	13	-	-	-5	10	-	7	17
	3 Years University	7	18	-	-	-	-	-	22	24
	4th Year University	12	- 9	-	-	-	-	-	-8	24
	Masters	-	-9	-	-	-	-	-	9	9
	Doctorate	-	-	-	-	-	-	-	15	-
Louw[32]	Sub A - Std 5	-	-	15,7	10,7	-	-	15,5	-	-
	Sub A - Std 10	-	-	14,4	11,6	-	-	13	-	-
	Sub A - 4 years Higher Education	-	-	13,3	12,3	-	-	11	-	-

(iii) SELECTED COMMENT ON THE RESULTS

(iii.1) THE SOUTH AFRICAN RESULTS AGAINST THE INTERNATIONAL STUDIES BACKROUND

Emerging from the international survey by Psacharopoulos, the average returns to primary, secondary and higher education were 23,7%, 16,3% and 17,5% p.a. respectively. The only study which produces results remotely similar to these was to these was that done by Louw. Although the Smuts/Terblanche study revealed declining rates of return to incremental levels of education, which is a trend evident in international studies, the actual percentage rates of return far exceeded those suggested by international comparisons. The study done by Joubert, which draws sample data from the same censuses, does not yield consistent trends on the whole, but where they are evident, far from the rates of return decreasing per incremental level of education, the results suggest that they may actually increase. The case of Coloureds relating to the 1960 census data is a good example - the first three years of primary education are estimated to yield only 1% p.a. return, the next five years 9% p.a. return, the next three years after this 16% p.a. return, the twelfth year (standard ten) an amazing 142% p.a. return and a diploma year following this - 5% p.a.! Giving a sensible economic interpretation to such results is extremely difficult. In the study undertaken by Louw on the other hand, the results seem to approximate those emerging from similar studies done in other countries fairly well, although the slightly rising rate of return to incremental education for the Blacks is something of an anomally.

(iii.2) THE SMUTS/TERBLANCHE STUDY [33]

Using a 10% sample of the 1970 census data for all groups and a 10% sample of Whites and a 20% sample of Asians and Coloureds from the 1960 census data, Smuts and Terblanche projected that the rates of return to Asian, Coloured and White education in 1960 and 1970 were as summarized in section (II.ii) of this chapter.

It should perhaps be observed right from the outset that the results produced by the Smuts/Terblanche study almost completely ignore the problems of the non-quantifiable benefits of education, as well as risk and uncertainty. It is also evident that the special problems which were noted in Chapter 2, namely, that rates of return per level of education cannot be 'pure' (unless some form of the 'overtaking' concept is used) because of their being averages to schooling and on-the-job training, and that earnings may not be a satisfactory measure for return on 'investment', are also almost completely ignored. Being an estimate of a private rate of return, the bulk of the criticism leveled at CBA as outlined is Chapter 1 is avoided, as this mostly relates to social return estimations.

What is particularly worrying about the Smuts/Terblanche study, apart from any of the above considerations however, are the meaninglessly large rates of return which they arrive at. Consequently, it is with this matter that the bulk of the comment on this study is concerned.

Consider firstly, their decision to exclude self-employed persons from their sample population on the pretext that a part of the return to these people is an ability return - those abilities related to entrepreneurial activity. Chiswick[34] (discussed earlier

in chapter 1) has pointed out that the danger in this is that it can lead to a serious understatement of the opportunity cost of education and hence overstatement of the rates of return to education, where a substantial portion of the work force is self-employed. If the less educated people constitute the bulk of the self-employed and one expects their 'pure' labour productivity to be higher than their similarily educated wage earning counterparts (as Chiswick argues one might) then by leaving them out, it follows that opportunity costs of education may well be understated. More generally, and in this respect the present writer differs from Chiswick, it is doubtful whether the separate treatment of abilities related to entrepreneurial activity is justified in any case. Abilities related to entrepreneurial activities are closely interwoven with a whole range of other abilities and character traits (eg. attitudes towards risk) and if one is going to attempt to standardize earnings for ability differences, then the accepted method of doing this, namely through use of the alpha coefficient, would still appear to be superior to any other methods. Their study makes no use of an alpha coefficient at all and thus ignores the ability issue generally which is particularly surprising in view of their belief that entrepreneurial abilities constituted an analytical problem. It would appear, then, that improper consideration of the ability factors could have had a twofold effect causing rates of return to appear excessive - earnings were not reduced to standardize earnings for ability factors and opportunity costs may have been understated by the Chiswick argument.

The main reason, however, why the opportunity costs are so small, is because of the timing assumptions of their model. For the purpose of determining foregone earnings they assumed that the first age of relevance for the

Asian and Coloured population groups was 15 years and for Whites, because of the legal schooling requirements, 17 years. As the State provided free White education and subsidized Asian and Coloured education, this reduced the costs of schooling to negligible proportions from the private point of view, and as a result, rate-of-return calculations become pretty meaningless. There is no cost on which to base a return on and one is left wondering what use there is in bothering to calculate such rates, (especially for the White group). For the Asian and Coloured groups the age at which foregone earnings are determined to be applicable could be lowered - the consequence of which would increase the opportunity cost of schooling significantly.

Smuts and Terblanche do attempt to evaluate education from the private perspective using the net present value criterion as well, selecting for this purpose a discount rate of 6%. From this they conclude that if no further study was intended (i.e. post-school) that it was not profitable for Whites to continue to standard 10 from standard 9 - a truly astonishing result[35] if one bears in mind the current popularity of the credentialist explanation of age-earnings portfolios.

(iii.3) THE LOUW STUDY [36]

Citing an article by Colby, Ditzian and Waxmonsky[37] published in 1977, Louw contends that there is a belief amongst some in South Africa that because of the policy of separate development it is not worthwhile for non-Whites to invest in human capital. Using a Mincerian approach on data collected by the Bureau for Market Research throughout the major urban centres in South Africa in 1975, he estimates the coefficients of various earnings functions specifications and from this is able to deduce rates of return to education for the

various non-White population groups - one set of which were presented in the table of results in section (II.ii).

An odd thing about Louw's contention that the article by Colby, Ditzian and Waxmonsky suggests that because of the policy of separate development it is not worthwhile for non-whites to invest in human capital, is that this hardly seems to flow from the article at all. In the article referred to, the findings of a survey covering twelve firms in the East London area(where 10% of the Black labour employed were asked to complete a questionnaire in order to determine what influenced Black wages) are very limited for interpretive purposes. The best explained regression on the determinants selected, (R^2 = 0,68; significant at 0,05 level with N = 220) was for a "low" income group (less than R26,00 per week) where the relative importance of the determinants was found to be, (in decending order of importance), sex, time spent on present job, total number of jobs, education, age and least important, marital status. For the "high" income group (more than R26,00 per week) the order of importance was, head of household, time spent on present job, have a home country, marital status and then education (R^2 = 0,46; significant at 0,05 level and N = 47). In their attempt to explain the variation in earnings across all the Black workers concerned they were not very successful, R^2 = 0,17. Whether one can deduce anything significant from such a restricted sample population or from these regressions is extremely doubtful. The economic logic underlying any interpretation of them is pretty flimsy - what interpretation does one place on determinants such as total number of jobs or head of household? Should these be positvely or negatively associated with wages? Consequently it is difficult to follow the pretext with which Louw associates the regressions published by Colby, Ditzian and Waxmonsky, namely that because of the

policy of separate development, it is not worthwhile for Blacks in South Africa to invest in eduation. The low relative importance of education in determining wages in their restricted survey does not seem sufficient for such a conclusion, although as admitted later in this section, it is a possibility .

The earnings function specifications used by Louw for the purpose of estimating, are of the Mincerian type:

(a) $\ln Y_j = f(S)$

(b) $IN Y_j = f(S, S^2, Exp, Exp^2, Exp. S)$

(c) $IN Y_j = f(S, S^2, Exp, Exp^2, Exp. S, e)$.

In the specifications (a) - (c) above, Y_j are the earnings of person j, S relates to years of schooling, Exp to years of experience and e is the Chiswick dummy variable to account for earnings resulting from entrepreneurial ativities rather than education. The S^2 variable is introduced to permit rates of return per level of education to be estimated by the first order derivative of earnings with respect to schooling, (for which we require the time variables to be continuous), and the Exp^2 variable is included because of the expected parabolic nature of the age-earnings curve over time.

For regression (a), the average rate of return to schooling for Black males was estimated at 5%, (R^2 = 0,08 and significant at 0,01 level). For regression (b), the rate of return to schooling may be determined per level and are those shown in the table of results in section (II.ii), where Exp is assumed equal to 10 years (R^2 = 0,17 and significant at 0,05 level). Fitting regression (c) to the data, produces marginal rates of return for Black males of 8%, 9% and 9,8% p.a. for the education cohorts used for regression (b),(see table) and assuming Exp equal to years (R^2 = 0,18 and significant at the 0,05 level).

Louw also attempted to determine rates of return by occupation, stating a belief that in order for the Blacks to gain access to higher paid jobs that "the homogeneity and undifferentiatedness of the supply of Black labour should be altered".[38]

However, the results from the regression done by occupation were not very inspiring in respect of Black males. For the highest R^2 regression (R^2 = 0,28), relating to those Blacks in professional occupations, the coefficients of the S, Exp and Exp. S variables were not significant at the 0,05 level and the rate of return to schooling becomes strongly negative. For the lowest R^2 regressions (R^2 = 0,07 and R^2 = 0,1; and N = 1234 and N = 1993 respectively) which related to semi-skilled and unskilled occupations respectively, and which formed the overwhelming bulk of the sample population, marginal rates of return to primary education of approximately 3% and 4% p.a. respectively, are yielded (and neither rates were significant at the 0,05 level). Bearing the above in mind, the fact that the regression relating to skilled Black male labour (R^2 = 0,25 and N = 203) enjoyed a rate of return to primary schooling of 13% p.a. (which was not significant at the 0,05 level) hardly seems a suitable backround against which to conclude that,

> "skilled labourers and administrative and clerical occupations have the highest rates of return to education. This is probably the most important result derived in this paper." 39

A more correct conclusion on the regressions performed relating to return on education by occupation, would have been that they allow very little to be said.

Notwithstanding the comments above, Louw's pioneering attempt to calculate rates of return to Black education

do deserve some credit - it is at least a start in a virtually unexplored field. The main source of concern is the very low explanatory power of the regressions which suggest that the human capital model is not well suited to the case of Black wages in South Africa - an interpretation which would endorse the results produced by the research done by Colby, Ditzian and Waxmonsky on the determinants of Black wages, rather than run contrary to it. In this context, although it does not necessarily follow from the studies referred to, the policy of separate development may well have played a role. The vastly inferior standard of Black education, racial discrimination in the labour market and institutionalized restrictions on Black career opportunities, which may all flow from the policy of separate development, could have distorted the Black earnings patterns in South Africa to an extent where years of education cease to explain earnings differences very well. However, the overall explanatory power of the functions estimated for the Blacks to which have been referred, are too low generally for anything other than the conclusion that at this stage, not very much may be said at all.

(III) SYNOPSIS

The application of CBA to Black education in South Africa has not attracted much research. Possibly the main reason for this is the inadequacy of the data, although doubts relating to the theoretical base underlying such an application and the current popularity of the alternative means to estimating rates of return to education, namely via the earnings function approach, could also have been contributory factors.

Research into rates of return are always done with a view to effecting comparisons. From the international surveys, inter alia, we learn that in less developed countries the rates of return to investment in human capital compare generally very

favourably with those on investment in physical capital, that rates of return to primary education are as a rule higher than those for secondary and higher education, and that if cross-national rates of return are compared they can serve to suggest the direction of the brain-drain. But the studies on rates of return to education done in South Africa do not yield many insights. All three studies surveyed, relating to private rates of return to the education of males for the various population groups in South Africa, yield results which conflict with expectations or inspire little confidence. The abnormally high rates of return produced by Smuts and Terblanche in their application of CBA to Asian, Coloured and White education, would appear to underestimate the opportunity costs of and over estimate the earnings from education. The random pattern of rates of return produced from the same censuses and for the same population groups as the Smuts/Terblanche study, though by an earnings function approach, by Joubert, are not only completely different to those of the Smuts/Terblanche study, but also conflict with expectations based on international comparisons and economic theory. The only study which produces results for Blacks and coincidently, which seem to tie up with international comparisons, was that done by Louw. But the major problem with his study, especially in the case of rates of return to Black education (rates of return to Asian and Coloured education are also calculated), is that the regressions on which his rate of return estimations are based, have such low explanatory value that very little can be concluded from them at all. In any case, all three studies calculate private rates of return to education which are only of use to the public decision-maker in so far as they approximate the social rates of return. Bearing in mind the wide disparities in rates of return calculated in the various studies discussed above, it seems unlikely that they can confidently be interpreted as the private rates of return, let alone the social rates of return. Furthermore, with a view to integrating rate of return results into a public decision making framework, this approximation may even be conceptually undesirable - one may <u>wish</u> certain effects to be

explicitly included or excluded in the rate-of-return analysis, eg. the effects of government intervention and externalities.

It is clear that a vast area relating to education planning is in need of research in South Africa. From the international comparisons it is evident that education makes a substantial contribution to growth, especially at the lower levels. Joubert has attempted to measure the contribution of education to the economic growth of South Africa, but on the basis of the rates of return referred to above. A study based on results which inspire more confidence is required. Also emerging from the international comparisons referred to earlier in this chapter, was the fruitful source of information which an analysis of the costs of education offers. The value of the non-quantifiable benefits of education was also stressed. Education planning in South Africa would benefit significantly by greater knowledge in these areas. In Chapter 4 possible guidance of education planning is considered, and the perspective selected in this respect is how the various techniques to which we have referred, most notably CBA, can be integrated into an education planning framework.

(IV) REFERENCES

1. Psacharopoulos, G. Returns to education: An international comparison. Amsterdam, Elsevier, 1973.

2. Psacharopoulos, G "Returns to education: An updated international comparison", Education and Income, World Bank Staff Working Paper, July, 1980, p. 75-109.

3. World Development Report. Washington D.C., Oxford University Press, 1980, p. 46-53.

4. Lockheed, M.E., Jamison, D.T. and Law, L.J. "Farmer education and farm efficiency, A survey", Education and Income, World Bank Staff Working Paper, July, 1980, p. 113-152.

5. Psacharopoulos, G. Returns to education, An international comparison. Amsterdam, Elsevier, 1973.

6. Psacharopoulos, G. op.cit., p. IX.

7. Psacharopoulos, G. op.cit.

8. Psacharopoulos, G. op.cit. p. 86.

9. Psacharopoulos, G. op.cit., Chapter 7.

10. Psacharopoulos, G. op.cit. p. 118.

11. Denison, E.F. The sources of economic growth in the United States and the alternatives before us. New York, Committee for Economic Development, January, 1962, p.

12. Psacharopoulos, G. op.cit., p. 118.

13. Psacharopoulos, G. op.cit., Chapter 2.

14. Psacharopoulos, G. op.cit.

15. Psacharopoulos, G. op.cit., Chapter 8.

16. Psacharopoulos, G. op.cit., Chapter 2 and 5.

17. Psacharopoulos, G. op.cit., Chapter 9.

18. World Development Report. ibid.

19. World Development Report. ibid.

20. Lockheed, M.E., Jamison, D.T. and Law L.J. ibid.

21. World Development Report. op.cit., p. 52-53.

22. de Lange, J.P. (Commission). Provision of education in the RSA. Reports of the Main Committee and Education finance Committee of the NSRC Investigation into Education, 1981.

23. Louw, S.J.H. "Income, education and experience - A case study of non-Whites in South Africa", Development Studies on Southern Africa, Volume1, Number 4, July, 1979, p. 391-415.

24. Smuts, J.S. and Terblanche, S.S. The private rate of return on investment in education in the Republic of South Africa for 1960 and 1970. Pretoria, Institute for Manpower Research, 1974.

25. Joubert, R.J.O. "Verdienstefunksies en die onderwys", South African Journal of Economics, Volumes 46, Number 4, December, 1978, p. 371-399.

26. Steenekamp, J.J.A. Income and expenditure patterns of urban Black households in Port Elizabeth-Uitenhage. Pretoria, UNIESA, Bureau of Market Research, 1976.

27. Bates, T. Aspects of the theory of human capital and its application to South African economic development. Unpublished Masters Dissertation, Rhodes University, 1973, p. 185-219.

28. Okedara, J.T. "Cost-benefit analysis of formal and non-formal education: A case study", Nigerian Journal of Economic and Social Studies, Volume 20, Number 1, March, 1978, p. 89-110.

29. Okedara, J.T. op.cit., p. 101.

30. Smuts, J.S. and Terblanche, S.S. op.cit., p. 39.

31. Joubert, R.J.O. op.cit., p. 396.

32. Louw, S.J.H. op.cit., p. 397.

33. Smuts, J.S. and Terblanche, S.S. ibid.

34. Chiswick, C.U. "On estimating earnings functions for LDC's", Journal of Development Economics, Volume 3,1976, p. 67-78.

35. Smuts, J.S. and Terblanche, S.S. op.cit., p. 43-44.

36. Louw, S.J.H. ibid.

37. Colby, D., Ditzian, J. and Waxmonsky, R. "Determinants of Black wages: A case study", South African Journal of Economics, Volume 45, 1977, p. 243-267.

38. Louw, S.J.H. op.cit., p. 401.

39. Louw, S.J.H. op.cit., p. 404.

CHAPTER 4

A MODEL FOR INTEGRATING THE APPLICATION OF CBA INTO THE PLANNING OF BLACK EDUCATION IN SOUTH AFRICA

In this chapter an attempt is made to develop a theoretical framework for integrating CBA into the planning of Black education in South Africa. The basic idea involves the construction of an 'impact of education matrix' in which the essential 'outcomes' resulting from the education of Black pupils are detailed. From this framework it is necessary to, (a) reduce the dimensions of the impacts to be considered and (b) develop some precision regarding the nature of these impacts, if any planning perspectives are to emerge. It is in the attempt to establish requirement (b) above, that CBA may play a role in respect of the planning of Black education. The case of Black education is considered as it is for this population group that most planning for the provision of education would seem relevant, though much of what is said is readily applicable to the other population groups as well.

The present chapter has three sections - the background, the basics of the model, and some thoughts on an introductory application of the framework to the case of Black education with special attention to the usage of CBA in this framework. The section on background, which follows immediately below, deals firstly with certain focal issues to emerge out of the De Lange Commission Report,[1] secondly with parity considerations in the provision of Black education (Malherbe's[2] viewpoint) and finally, with some observations on current economic theories relevant to education planning.

(I) THE BACKGROUND

(i) THE DE LANGE COMMISSION REPORT[3] - FOCAL ISSUES

There can be little doubt that the provision of education for

for Blacks in South Africa has become a very important issue in our society. One indication of this has been the spectacular growth which has recently taken place in the provision of Black education and another indication was the commissioning of the Human Sciences Research Council by the government to report on the provision of education in South Africa (the De Lange Commission Report).

The spectacular growth in the recent provision of education for the Blacks is evidenced by the growth in the Black school-going population over the period between 1960 and 1980. The Black primary school population grew at a rate of 5,2% p.a. to rise from 1452 000 or 58% of the total primary school population in South Africa to 4 004 000 or 74% of the total, over this period, and the Black secondary school population increased from 15% to 58% of the total over the same period,[4] growing most rapidly from 1974 to 1980, when the numbers increased from 147 320 to 555 138 in pupils.[5] (Note that the figures relating to the 1974-1980 period exclude the independent homelands whereas the other figures include them.) Nor has this trend shown any sign of abating. The Department of Education and Training, for example, report that between 1979 and 1982 their expenditure on Black education increased from R143 858 000 to R369 748 000, an increase of 157% over three years.[6]

The main orientation in this section however, relates to the other indication of the rising public concern for Black educational provision referred to, namely the De Lange Commission Report. The purpose of the Report was to provide some guidance on the issue of the direction and magnitude required in the provision of education for all in South Africa. The economic perspectives provided in the report in regard to this provision are however, not very substantial. There are, inter alia, suggestions that education should be more technically and vocationally orientated, that there should be more parity in educational provision between population groups in South Africa and that there should be greater flexibility in the educational structures in

South Africa, though with a compulsory basic education for all. But equally clearly, it emerges that there exists considerable uncertainty concerning the economic ramifications of the recommendations of the report. The 'economics' contributions on the report appear to be restricted to stating, (a) that a case can be made in principle for expenditure (private or public) on education on the grounds of enhancing individual consumption and productivity and (b) that because there exist positive externalities arising from education and because it is the State's responsibility to redistribute incomes, that there exists a justification for public expenditure.[7] One would have thought in a report of this nature, that a little more guidance than this and estimating the cost of achieving parity in educational provision between the population groups in South Africa, could have been provided.

One of the themes to emerge out of the report was the need to break away from the overwhelming bias towards the universities in our educational systems. Malherbe, in an analysis of the economic aspects of education in South Africa, has also objected to this bias. But as is the case in respect of the report, he too does not have a firm basis for this - the fact that the growth in the expenditure on university education has far outstripped the growth in GNP[8], on its own, in no way substantiates the position taken against the university bias in South African education. In the de Lange Commission Report it is felt that this type of education is not ideal for the purpose of achieving economic development because it fails to provide the technicians and technologists needed to sustain development and in its place creates an unemployable mass.[9] Using the Commission's assessment of problems related to the educational structure in South Africa, (Chapter 3, sections 3.3 and 3.4), it would appear that the following are related to the failure of the education system to provide the necessary technicians and technologists:-

(a) the academic value system in South Africa which has led to the neglect of technical and vocational training;

(b) the limited facilities available for this provision;
(c) the shortage of suitably qualified teachers;
(d) the inadequacy of vocational guidance at school;
(e) the lack of opportunity of a large proportion of people in the non-White groups to acquire a practical backround in technology and management which serves as a basis for a sound grasp in the mathematic, scientific and commercial fields;
(f) the need for curricula revision to accommodate a greater a diversity of users;
(g) the present ineffective, rigid and closed structure of education which does not permit pupil/students a suitable variety of options at the post-primary levels of education.

As an alternative to the present system the report proposes seventeen grades of differentiation in the education system. Level 0 is termed pre-basic and corresponds to to pre-primary schooling. (The possibilities of compensatory education for the non-White population groups is also considered at the pre-basic schooling level.) Levels 1-6 are termed basic (primary school largely) and are proposed as being compulsory, levels 7-12 are termed post-basic-intermediate, (academic, technical and vocational secondary schools), but an option of non-formal training (on-the-job) is recommended as a serious alternative at this level, and levels 13-16 are termed post-basic-higher (universities and technicons). The emphasis would appear to be on connecting that which is done in formal schooling with what is required in the economy to a far greater extent than in the past. (Note that the terms vocational education and technical education are very closely linked although the former is sometimes taken to relate purely to commerical type studies.)

What is worrying from an economic perspective, is the evidence, or rather the lack of it, on which the greater emphasis on technical and vocational education is often recommended for the case of South Africa. The case is usually based on manpower requirements projections and a current shortage of technicians,

but the problem is, that while these indications may indeed be suggestive of a need for more technically and vocationally trained people in the economy, they are not sufficient to base an economic case for providing more technical and vocational education at the expense of academic education. For this purpose we need to compare the marginal productivity yielded by academic and technical training in South Africa over time - something which was not done. This is not to say that the task of measuring productivity is underestimated - labour market imperfections may well cause rents and quasi-rents to be earned. Certainly, mere observations on apparent labour market conditions are not sufficient for this purpose. For example, consider the comments of Griffiths and Jones[10], who argue that there is a need for more technical education as against university education in South Africa. To 'substantiate' this we are informed that of the approximately 10000 annual doctorates in the humanities and social sciences in the USA, that there were employment opportunities for only 1400, ('social scientists' apparently, did not include economists as there were 2000 jobs available to only 700 doctorate achievers in the field of economics), in a recently conducted survey there.[11] Maybe this is interesting, but it is difficult to see how this is of any consequence to the issue of whether there should be more technical rather than academic educational provision in South Africa.

Perhaps the major theme which runs through the De Lange Commission Report is the need for parity in educational provision, although it is clear that there was some concern at the enormous financial cost involved, and related to this, at the need to maintain alternative expenditures. This concern is expressed by:

(a) the recognition that other objectives, such as the upgrading of living conditions in urban areas and health are directly related to educational performance; and

(b) the appreciation that increasing expenditures on education must involve sacrifice. Education expenditure as a percentage of consumption expenditure in the budget, was

> projected to increase from its present 22% to between 30-40%.[12] Furthermore, it is estimated that up to 40% of the total capital investment in non-residential buildings in South Africa would have to be spent on school buildings <u>just</u> to eliminate the back-log - a figure which does not include the independent homelands.[13]

However, except for these considerations, the economic analysis offered in the report relating to the question of parity is not very substantial. Speculation is offered to the effect that:

(a) a redistribution of expenditure between the population groups <u>may have</u> yielded a higher return on education to society, or

(b) a maintenance of the present skewness in the distribution of educational provision (favouring the highly educated), but with a non-discriminatory selection basis for entry into the 'elite' group, <u>may have</u> yielded an even higher rate of return to society.[14]

However, these arguments are not sufficiently detailed to justify the massive expenditures projected to achieve parity. It seems worth considering then, some more detailed economic arguments for parity - we now consider those of Malherbe.

(ii) PARITY CONSIDERATIONS (MALHERBE[15])

Malherbe bases his economic arguments for parity in educational provision on the existance of unexplainable wage differences between the various population groups. Using 1970 census data he finds, inter alia, that White matriculants earned three times as much as their equally educated Asian and Coloured counterparts, that 48% of Whites with only a standard 5 qualification earned more than R2000 p.a., whereas less than 0,4% of Asians and Coloureds who held university degrees earned more than R2000 p.a.[16] No earnings data were available for Blacks in the 1970 census, but it seems fair to assume that they were no more highly rewarded than the Asians and Coloureds. While

Malherbe agrees that differences in ability and the quality of schooling could have marginally caused Whites to enjoy higher earnings, he rejects the assertion that these explain the full extent of the discrepancy. Instead he blames the present socio-political system which he argues has inflated White salaries and prevented non-Whites from realizing their full productivity potential. He suggests that while the status quo is maintained, such that Whites cannot work under non-Whites, the under-realization of the non-White earnings potential will continue.

This is a powerful argument and one which casts considerable doubt on whether rate of return (or any productivity) based arguments can be used to assess the question of the provision of education amongst the different population groups. A credentialist theory would appear applicable to the case of education in South African the first credential being the colour of one's skin (according to Malherbe) and the second only, being education. Oddly enough however, Malherbe appears to believe in human capital theory rather than credentialist theory. On totally inadequate evidence, namely Joubert's[17] study (Blacks were not included in this study), he asserts that;

> "There can be little doubt, if an earlier beginning had been made in developing the vast unexploited reservoir of human resources latent in the non-White population, not only their productivity but the overall productivity of the country would have been accelerated".[18]

What is also confusing, is that having used Joubert's study to substantiate the link between education and economic growth and adopting a human capital motivation for Black education, he rejects the higher earnings of educated Whites as being a reflection of increased productivity over less educated Whites, arguing instead that it is based on social privilege, snob values and protection in public service employment.[19] Notwithstanding the above perculiarities, it still seems perfectly

reasonable that the question of socio-political discrimination should be borne in mind in any assessment of the impact of education for the purpose of planning Black education. In conclusion then, it would appear that the main contribution to economic analysis which emerges from parity considerations is that the human capital model requires the removal of socio-economic discrimination in the labour market before it becomes applicable in the case of South Africa.

(iii) SOME OBSERVATIONS ON CURRENT THEORETICAL APPROACHES TO EDUCATION PLANNING

Layard[20] has identified two main schools of thought on educational planning. One school argues that educational provision should adjust to the manpower requirements emerging from an analysis of the labour market, while the other school argues that education provision should purely adjust to the private demand for education. The manpower versus rate-of-return debate is identified with the former and the debate over the criteria for the financing of education is identified with the latter school of thought. Using this framework as a basis for discussion in this section, some observations on current theoretical approaches to education planning are made.

Consider the school of thought which argues that educational provision should adjust to labour market demands in order to avoid growth-restrictive disequilibria situations from arising in the economy, for example, Cobb-Webb cycles. There are two common approaches to this problem - a manpower requirements approach and a social rate-of-return approach (CBA determined for our purposes). In chapter 1, it was established that one could not hope for numerical precision in a CBA, but that there was scope for evaluating alternatives and perhaps drawing inferences about the relative magnitude of expenditure on different projects, providing that this did not relate to non-marginal changes. This does not mean, as has been argued[21] in respect to manpower and rate-of-return analyses in Africa, that because major structual changes are implicit in most envisaged

education expansion programmes in Africa, CBA is irrelevant. Even where major changes are made, CBA may still play a role in 'fine-tuning' the educational provision to an optimum - this being done by equalizing the actual rate of return to education with the social discount rate and by taking into account the elasticity of demand for educated labour.[22] If the actual rate of return on education exceeds the social discount rate, then more needs to be spent on education, and conversely, if the actual rate of return on education is less than the social discount rate, then less needs to be spent on education. In both cases the extent of the change in provision of education depends on the elasticity of demand for educated labour.

Admittedly though, on its own a CBA approach may be insufficient, as no provision is made in its calculus for shifts in demand over the future. To bring this perspective into the analysis some form of manpower forecasting would appear to be necessary. The two techniques would seem to offer the following potential then, (a) a manpower requirement forecast is used where one seeks to take into account shifts in the demand for educated manpower and (b) CBA is to be used where one seeks to 'fine-tune' the provision of educated manpower to labour market needs.

Note that one cannot judge the success of a technique for the purpose of guiding decision making in education purely by conditions in the labour market. Governments often will not act on the advice emerging from such studies. This is one of the reasons why Jolly and Colclough[23] see a bleak situation of mass educated unemployment arising in Africa despite the many manpower and rate-of-return studies done: they surveyed thirty and ten of each type of study respectively, for example. The fact that manpower plans are seen only as influencing "the climate of opinion rather than clear guidelines for action"[24] and the fact that the wrong type of education, i.e. not enough technical training, has been provided, is blamed for this situation.

None-the-less, on the face of it the use of the techniques for purposes (a) and (b) described above sound very sensible, although the approach does tend to ignore the problems inherent in each technique which reduce their usefulness for the purposes described. In chapter 2 we noted that the rigidities and uncertainties associated with the manpower requirements approach did not lend it much credence, and one thing which almost everyone agrees upon, is that CBA cannot be used for precision results, and thus by implication, for 'fine-tuning'. However, despite the inadequacies of the techniques it would seem that we are still on the right track. Combined they offer perhaps, the best possible source of guidance currently available for educational planning purposes, provided that the only consideration is that of current and expected future labour market situations and also that necessary refinements are built into the techniques.

The other school of thought on the provision of education suggested as being in existance (by Layard), consists of those who believe that education should be provided on the basis of the private demand for education. Presumably individuals in terms of this should pursue education until their discounted net present value resulting from education is zero. Thus the private demand for education would be determined by the private discount rate, i.e. the private IRR to education. But this provides very little in the way of guidance for public expenditure on education because the difference between this rate of return and the social IRR is largely brought about by the pattern of education subsidies by the government. It is not the difference between the respective IRR which determines the subsidy patterns in education, but these subsidy patterns which determines the difference between the two types of IRR, i.e. we are still left with the problem of how the subsidy patterns should be determined.

We have already noted that there are 'economic' grounds for subsidies, (in the discussion of the de Lange Commission Report), namely, the existence of non-excludable externalities and by redistributional considerations[25] (which is based on a

diminishing marginal utility of income hypothesis). However, these grounds to not provide much guidance on what the ideal size of the government subsidy should be. In the face of the uncertainty over what the ideal size of the government subsidy should be, where the view is adopted that the private demand for education should largely determine its public provision, it is surprising that most non-centrally planned economies do seem to follow this policy, though with the restriction that the individual must qualify by ability or attainment for a place at a higher education institution. Notwithstanding this, because of its relevance, it does seem appropriate to comment on a few problems associated with this practice. One of the biggest of these problems arises from the possibility that people may demand education with inadequate foresight and as a result face unproductive employment or even unemployment, later in life. One way around this is offered by adopting a policy of recurrent education (RE). This approach to education provision would appear to be becoming increasingly popular in Western Europe.[26] The idea is that after the compulsory period of basic and intermediate levels of education, that higher education be postponed and or interrupted by part and full time work at certain stages - the result being the extention of education later into working life. Not only is it suggested that this serves to produce a more effective relationship between education and the labour market, but also that it provides a second chance for the older generations who for some reason missed educational opportunities at a younger age. (For these people study leave on full pay is recommended.) One should however, not expect too much to change with the introduction of the RE concept if one follows the Ben-Porath model[27] outlined earlier, as we established in this model that it was more advantageous to acquire ones education at an early an age as possible.

Another major problem related to the private demand determined approach to education provision, relates to the financing of those who have less means to sponsor their children though schooling. Papanicolaou and Psacharopoulos have argued on the grounds of economic <u>efficiency</u> that the children of parents of

a lower socio-economic status should benefit more by government subsidies than children with parents of a higher socio-economic status, based on the negative relationship between socio-economic status and rates of return to education, which they established in their study.[28] The whole concept of a means-based government subsidy (which would be implied by this) for education would however, require fairly careful analysis of the sociological implications of this. The finding is nevertheless highly pertinent to the parity issue which we discussed earlier in this chapter,in that it does suggest that if it is applicable to South Africa as well, then not only may parity in expenditure be economically justified but even compensatory expenditure. There is however, no reason why this finding (for the United Kingdom) should also be applicable in the case of South Africa. In Brazil, a country more similar to South Africa in development, the opposite relationship to that described above, would appear to be applicable, namely that returns to education are higher for children of parents with a higher socio-economic status.[29]

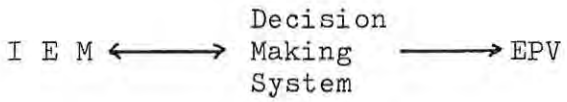
As a final observation, it is worth noting that there exists enormous scope for research in respect of the planning of education. But what is extremely important, is that this is done in the context of an overall framework and because of the vast number of considerations in the planning of education - the framework has to have flexibility. It would seem that the matrix and vector mathematical concepts are ideal for this purpose.

(II) THE BASICS OF THE MODEL

(i) THE FRAMEWORK

Reference in this thesis has frequently been made to the possibility of developing an all inclusive education matrix from which some perspectives on public planning could emerge. The possibility of such an approach is now considered for the case of providing guidance on the planning of Black education

in South Africa. The method by which it is suggested that this takes place is through the connected concepts of an impact of education matrix (IEM) and resultant education planning vector (EPV). The proposed matrix consists of a structured set of 'outcomes' arising from educational provision and using this as a basis, it is suggested that in principle a resultant planning vector may be derived. The concept of a vector is selected for this purpose because ideally, analysis of the IEM should lead to guidance on both the direction and magnitude of educational provision - these two components being the properties of a vector. As seen immediately below, the model involves two steps - determination of the IEM and derivation of the EPV therefrom, by considering the interaction between the IEM and the decision making system.



The composition of the IEM and derivation of the EPV for the special case of planning Black education in South Africa is the topic of the (next) final section of this chapter. But before moving on to this topic, let us consider at a more general level, something of the possible nature of the IEM and the relationship between it and the EPV. The possible nature of an IEM is outlined on the following page.

(ii) THE NATURE OF AN IEM

CATEGORIES OF IMPACT

(A) ECONOMIC		(B) SOCIOLOGICAL	(C) CULTURAL	(D) PHILOSOPHICAL, INTELLECTUAL AND SCIENTIFIC	(E) FUTURE GENERATIONS
(I) Investments	(II) Consumption				
On the development of,	On the satisfaction associated with the,	On the appreciation of the,	On the development of,	On the stimulation of,	On the responsibility towards the issues of,
1. cognitive skills, eg. recording, communicating and logical and analytical reasoning powers	1. ego-prestige aspects of acquiring education	1. requirements for all in society to realize their full human potential and achieve dignity	1. religous and moral awareness	1. understanding the nature of the world and universe in which we exist	1. population explosion associated problems
2. vocational skills	2. joy of understanding or acquiring knowledge	2. notion of consensus social behaviour	2. appreciation for the arts and environment	2. new ways of looking at things	2. conservation problems, eg. depletion and damage to natural resources and radioactive waste accumulation
3. attidues towards work, eg. development of a work ethos, and flexibility towards modernizations		3. particular social problems associated with poverty, health and overpopulation	3. traditions and history of own and awareness of those of other groups of people	3. furthering exploration in all fields of human activity	3. an intergeneration standard of living tradeoff
4. non-cognitive skills, eg.initiative, greater self reliance and ability to organize and make decisions		4. egalitarian ideals			4. the need to preserve materials of historical value

Possibly some traditionalists would consider many of the non-economic related items detailed in the IEM as somewhat fanciful or be more used to discussing them simply (and often vaguely) as types of "externalities". Furthermore, some items may be relevant to more than one category, and other relevant items apparently be completely ignored, eg. the negative consumption impacts of education (although we do discuss these at a later stage). Certainly, the IEM sketched above should not be seen as exhaustive. The primary value of the IEM is that it provides a framework within which the results of education may be comprehensively summarized in an ordered way. The present writer is well aware that there are different ways of showing how "everything hangs together", but the problem with many of these approaches is that they do not lend themselves to analysis for decision making purposes in the planning of education.

(iii) USE OF THE FRAMEWORK - A POSSIBLE HIERARCHY OF EDUCATIONAL IMPACTS

The purpose and usefulness of this framework is best seen against the background of the discussion in chapter 1. One of the main difficulties that emerged from the discussion of CBA for the purpose of decision-making was that of incorporating non-quantifiable considerations in its calculus. This difficulty may at least in principle be accommodated by the use of this framework where a whole range of non-quantifiable considerations are allowed for. But the question of how such a framework may be used for the purpose of decision-making in the planning of education, still demands a practical answer. Some guide-lines in this direction are considered below.

On the surface, this would seem to require that each impact be measured and weighted, but fortunately this enormous task would not appear to be actually necessary. The reason for this is that certain categories are likely to predominate at any one time for a given population such that a more limited focus on these categories is permissable (from a planning perspective).

Of the six categories of educational impact outlined in section (ii) above, we consider three main groups of these namely,

(a) AI and A II,

(b) B and C

(c) D and E.

In an analogous way to Maslow's[30] hierarchy-of-needs analysis in respect of human motivation, it is argued here that there is a hierarchy of needs for educational planning purposes which may be used for the ordering the impact-of-education groupings described in the IEM. In this context, one could term the impacts related to category (a), as lower order needs and those related to (c), as higher order needs. The importance of a particular impact on society would, by this hypothesis, depend on its level of socio-economic development. In much the same way as Maslow would argue that a person's basic physical needs predominate his motivations where his survival is at stake, so it is argued here, that for a poor and undeveloped population, the need for economic advancement is predominant and thus that group (a) impacts are the most important for the population (especially the investment impacts). But as the population develops economically, so other considerations rise in importance, for example, the sociological and cultural impacts of education. This is of course not to say that the same holds true for everyone in the population, but the fact that there are exceptions does not invalidate the basic guiding principle on which the main thrust of education planning may be orientated.

The main implications of this hypothesis in respect of the determination of an EPV for a particular population are that the focus of educational provision can be limited largely to those categories which seem relevant to a particular population's level of development. It follows that what may suit one population group may not be well suited to the educational needs of another. In the case of South Africa this would appear to be particularly relevant and involve a departure from the idea that education provision for the Blacks should ideally be a direct copy of that provided to the Whites, which would seem

to be motivated by parity considerations rather than any other analysis.

(iv) FOCUS ON THE ECONOMIC IMPACTS

Traditionally, economists have been most interested in the economic investment impacts of education (A I) and it would appear that this is made up of four main components, namely, the development of cognitive skills, vocational skills, attitudes towards work and non-cognitive skills.

Economists of the human capital school usually argue in terms of the first two components, to substantiate their case that education causes an increase in productivity. The development of literacy and numerical competence, which is often cited in this respect, would clearly relate to the cognitive skills in the IEM of section (ii) above. In respect of the third component referred to, it has been recognized for many years that attitudes play a strong role in the economic development of a population. Sadie[31], as far back as 1960, emphasised its importance in respect of the Blacks in Southern Africa - he refers to the need for "a revolution in the totality of social, cultural and religious institutions and habits, and thus in their psychological attitude, their philosophy and way of life",[32] if they are to become a force in economic development. The role of education in bringing about this change is potentially significant. Perhaps the most important impact in this respect is the development of greater flexibility towards modernity, although it would appear that this process needs to be approached gradually if stress and strain, and rejection, are to be avoided.

The fourth component referred to above, namely the impact of education on the development of non-cognitive skills, is particularly interesting in view of the concern for the type of education that should be provided to Blacks in South Africa. In a recent article in which he attempts to survey research

done on the impacts of primary schooling on economic development, Colclough[33] observes that higher levels of education do not necessarily lead to higher cognitive achievement in general, but that higher levels of education do appear to be associated with greater non-cognitive impacts. In view of the fact that many of these skills are required of management it would seem reasonable to suppose that they may be very significant in order for individuals to attain high levels of productivity. Thus, higher education, mainly through the development of non-cognitive skills, may play a singificant role in the enhancement of labour productivity. Consequently, too early a vocational orientation may prevent the full realization of this development and thus greatly limit the potential productivity of the individual. This would suggest that there may be a need for caution before sacrificing higher and academic education for the sake of a more vocationally orientated education. On a terminological note, it could be argued that 'affective skills' should replace 'non-cognitive skills' in the IEM, on the grounds that the latter term is misleading. However, this would not seem to require that there be any significant change in the analysis.

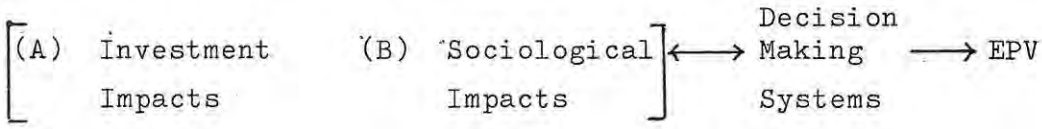
The other category of economic impact described in the IEM was that relating to consumption. Most economic analyses of education refer at some point to the consumption components of education, but the present writer is of the opinion that its inclusion in the analysis merits reconsideration. The reason for this arises out of the insufficient consideration given in conventional economic analysis to the negative consumption impacts of education which is simply, not realistic. Consider for example, the resentment of being compelled to complete schooling which is experienced by some individuals or the humiliation associated with failure and the feelings of not being able to cope or understand. It may be that the positive consumption effects experienced by some individuals are balanced by negative consumption effects experienced by others. For the lack of relevant information then, the consumption impacts of education are ignored in the remainder of this analysis.

We now consider how an EPV could emerge from an analysis of the IEM for the particular case of the Black people in South Africa.

(III) SOME THOUGHTS ON AN INTRODUCTORY APPLICATION OF THE FRAMEWORK TO THE CASE OF BLACK EDUCATION WITH SPECIAL ATTENTION TO THE USAGE OF CBA IN THIS FRAMEWORK

In this section an outline of how an EPV relating to Black education may be developed using the concept of an IEM, is presented. It is shown that in order to determine an EPV, it is necessary to (a) reduce the dimensions of the IEM and (b) develop some precision regarding the components of the IEM, and it is primarily as a result of this requirement, that abstractions from the IEM, such as using earnings differences to measure productivity, are made necessary.

In the IEM (of section II), six categories of impact were described - the hypothesis being that those to the left were more important to poorer, less developed people, but that as individuals became wealthier and more developed, increasingly those to the right became important aswell. In order to consider the provision of education to a certain group of people, this hypothesis would imply that their level of development should be borne in mind. Using this as motivation, it seems reasonable to argue that because the Blacks in South Africa are on the whole a poor and undeveloped population group, for them category A is of considerably greater significance than the other categories. However, perhaps in the case of South Africa, because of the somewhat expectional social context prevailing, the sociological impacts of education may be more significant than suggested in the model described above. Hence, in the IEM shown below the sociological impacts of education are also included. It is then, within the framework of the reduced IEM shown below, that an EPV relating to the Blacks could in principle be determined, given the appropriateness of the arguments above.



Unfortunately, even in its reduced form, the IEM as it stands above, is not well suited to the determination of an EPV. The reason for this is that the IEM is merely a statement of benefit; no implications of the opportunities foregone have been considered and no measuring rod has been applied to these benefits - both of which are necessary considerations before any ideas of the nature of an EPV could emerge. A very suitable category in which to directly introduce these considerations, is category A, and in fact, this is the current practice, i.e. what is being done in CEA and CBA studies.

Introducing the notion of foregone opportunities and a monetary scale allows us to reduce consideration of the economic impacts of education to a breakdown of various costs and returns to investment in education over time. The costing is possibly the less controversial of the two issues (notwithstanding the principle of shadow pricing which may well be relevant here) and for this reason it is often only the costs which are monetarily valued. Some other type of measure has then to be developed for the economic impacts of education in order to obtain greater clarity on the nature of an EPV - some index could perhaps serve this purpose in a very partial analysis. Such type of analyses are described as CEA and an example of where they could be useful, arises in the provision of guidance on the notion of optimal pupil to teacher ratios. The first step involves developing an index of pupil attainment (test scores, attitudes, etc.) and measuring variations in this index, resulting from variations in the pupil to teacher ratio (ceteris paribus). The second step is to compare this index to the costs associated with various pupil to teacher ratios. From this comparison, hopefully, some precision on the nature

of the trade-off between 'quality' of schooling and pupil to teacher ratios is provided. In chapter 3 we suggested that this trade-off may not be as significant as one might, on the face of it, believe. Unfortunately however, the conclusions based on CEA have to be limited, as two different measuring rods are used for costs and benefits.

To achieve clearer definition on the nature of the EPV for the provision of Black education, we need to use the same measuring rod for opportunity costs and benefits, and having decided to do this, the CBA technique becomes applicable. CBA would appear to be the most comprehensive approach to guiding decision making on a comparison of the costs and benefits although clearly, one has to take account of the issues raised in chapter 1, such as, the need to incorporate risk and uncertainty considerations, the impossibility of value-free social ranking as suggested by the theory of second best, the difficulty in determining an appropriate social discount rate, and the difficulties raised by the use of earnings to measure the benefits of education. But as was shown in chapter 1, a great deal of adjustments are possible in the CBA, such that many of the above considerations may be incorporated and if CBA is also complemented by a manpower requirements approach along the lines discussed earlier in this chapter, it would appear that considerable definition on the nature of a suitable EPV for the Black population can nevertheless emerge.

But what of the parity considerations referred to earlier in this chapter, from which it seemed possible to imply, that because of the existence of socio-political discrimination against the Blacks, that rate-of-return analysis was not of much use in guiding education planning? This however, is not the case and it brings us to consideration of the second part of the IEM - the sociological impacts arising from education - a consideration made necessary by the particular socio-political order in South Africa.

To achieve the necessary precision for the purpose of guiding educational planning, it was necessary to abstract from the direct investment impacts (i.e. use earnings differences as a guide to increases in productivity). It is also necessary to abstract from the sociological impacts for this purpose, and the approach recommended here, is to use the soical forces which emerge as a result of these impacts on individuals. For the particular case of Black education in South Africa it seems likely that the sociological impact is potentially enormous. As their appreciation of their "low" status in society grows, so one could expect mounting demands for a reshaping of the social order in South Africa, for example, by the removal of socio-economic discrimination in the labour market. This in turn, may of course, directly affect their rates of return on education, by Malherbe's arguments. The more orientated the education toward highlighting the sociological impacts, the greater one would expect this impact to be, and the more technically or vocationally orientated the education (which is not necessary equivalent to a productivity orientation), the less powerful one would expect this impact to be. But this should not be seen as an argument that because of the existence of socio-political discrimination against the Blacks in South Africa, that the results produced by CBA and related techniques, are invalid. These considerations may be considered alongside the economic ones for the purpose of determining an EPV for the Black people.

Finally then, where do these considerations lead us in respect of the nature of the EPV? In chapter 3 we reviewed rate-of-return studies which were relevant to a CBA application to Black education in South Africa. However, nothing very definite was determined in this review. Certainly, there was no basis for concluding that rates of return to Black education are higher than those relating to other population groups in South Africa. It does appear however, that the sociological impact of education is likely to be very powerful, unless a technical or vocational orientation predominates the nature of education

provided. The latter is in fact, currently a popular recommendation based on the investment impact of education, but economically it is not necessarily well founded. In respect of this it could be observed that investment impact arguments cannot be based on manpower requirements suppositions - productivity must be brought into the argument and CBA would appear to be the only comprehensive approach achieving this end, albeit, not without qualifications. In a nutshell then, there does not appear to be an investment impact case yet, for expanding Black education in South Africa, in any particular direction except that with a sociological orientation, and here the case rests on changes it would be expected to bring in the socio-political dispensation in South Africa. Consequently it would be surprising if the government was not hesitant about the idea of expanding the provision of education of this nature for the Black population,although they may be prepared to do this if it was sufficiently technically or vocationally orientated. The main problem from an 'objective' analytical point of view, is that so little empirical research has been done, that at the present time it is very difficult to specify logical avenues of educational provison for the Blacks in South Africa from an investment perspective. Nevertheless certain useful conclusions do emerge from economic analysis of the implications of this provision - five of which stand out in particular, namely:-

(a) The economic case for greater educational provision to the Blacks may well rest on the removal of socio-political discrimination against this group. The effect of this would be to make their employment opportunities more equal to that of the Whites and may as a result significantly raise private and social rates of return to their education.

(b) It seems logical that the investment impact of the educational provision to the Blacks should be emphasised. But this does not mean that education should be vocationally orientated. The mastery of vocational know-how is but one of the productivity associated impacts of education and it is by no means established that it is the most significant one.

(c) Education is provided against a dynamic background and should be continually adapted to this background. If cognizance is to be taken of the needs of the Black population, then it follows that an economic rationale may not always be the dominant factor in determining what education is provided to them. As they develop, other impacts of education may become of increasing importance to them - indeed,it was argued that the sociological impact of education was already of great importance to them because of the particular social context prevailing in South Africa.

(d) The educational needs of each population group are perhaps best analyzed separately as it would appear that the different population groups are currently at significantly different stages of development.

(e) Finally, and perhaps in terms of this analysis, most significantly,far greater use of economic analysis, particularly the use of CBA, may be made in the guidance of educational planning.

(IV) REFERENCES

1. de Lange, J.P. (Commission). Provision of education in the RSA. Report's of the Main Committee, Education financing Committee and Building services Committee of the HSRC Investigation into Education, 1981.

2. Malherbe, E.G. Education in South Africa, Volume II, 1923-1975. Wynberg, Juta, 1977, p. 535-538 and 604-659.

3. de Lange, J.P. (Commission). ibid.

4. Lombard, J.A. (Editor). "Employment through education", Focus on Key Economic Issues, Number 27, November, 1980, p. 3.

5. Botha, W. "Black education: Making dramatic strides year by year." Growth: Journal of Development in Southern Africa, Volume 2, January, 1982, p. 11.

6. Botha, W. ibid.

7. de Lange, J.P. (Commission). Finance Committee. op.cit., p. 1.

8. Malherbe, E.G. op.cit., p. 630.

9. de Lange, J.P. (Commission). Main Committee. op.cit., p. 19-20 and p. 26.

10. Griffiths, H.R. and Jones, R.A. South African labour economics. Johannesburg, Mc Graw-Hill, 1980, p. 1-21 and 247-251.

11. Griffiths, H.R. and Jones, R.A. op.cit., p. 10.

12. Browne, G. "Can South Africa afford de Lange?" National Education Conference on the Future of Education in South Africa, February, 1982, p. 2.

13. de Lange, J.P. (Commission). Finance Committee. op.cit., p. 35.

14. de Lange, J.P. (Commission). Finance Committee. op.cit., p. 6.

15. Malherbe, E.G. ibid.

16. Malherbe, E.G. op.cit., p. 635.

17. Joubert, R.J.O. "Onderwys en economiese groei in Suid-Afrika", South African Journal of Economics, Volume 47, Number 2, June, 1979, p. 136-155.

18. Malherbe, E.G. op.cit., p. 616.

19. Malherbe, E.G. op.cit., p. 658-659.

20. Layard, R. "Economic theories of education planning", Essays in honour of Lord Robbins, (Edited by Preston, M. and Corry, C.) London, Weidenfeld and Nicolson, 1972, p. 118-149.

21. Jolly, R. and Colclough, C. "African manpower plans: An evaluation", International Labour Review, Volume 106, 1972, p. 207-264.

22. Layard, R. op.cit., p. 120-125.

23. Jolly, R. and Colclough, C. ibid.

24. Jolly, R. and Colclough, C. op.cit., p. 253.

25. de Lange, J.P. (Commission). Finance Committee. ibid.

26. Blaug, M. and Mace, J. "Recurrent education - The new Jerusalem", Higher Education, Volume 6, Number 3, August, 1977, p. 277-299.

27. Ben-Porath, Y. "The production of human capital and the life cycle of earnings", Journal of Political Economy, Volume 75, August, 1967, p. 352-365.

28. Papanicolaou, J. and Psacharopoulos, G. "Socio-economic backround, schooling and monetary rewards in the United Kingdom", Economica, Volume 46, 1979, p. 435-439.

29. Jallade, J.P. "Basic education and income inequality in Brazil", World Development Journal, Volume 10, Number 3, March, 1982, p. 187-197.

30. Maslow, A.H. Motivation and Personality, (Second Edition). New York, Harper and Row, 1970, p. 35-58.

31. Sadie, J.L. "The social anthropology of economic underdevelopment", Economic Journal, Volume 70, June, 1960, p. 294-303.

32. Sadie, J.L. op.cit., p. 302.

33. Colclough, C. "The impact of primary schooling on economic development: A review of the evidence", World Development Journal, Volume 10, Number 3, March, 1982, p. 173.

CONCLUSION

The provision of Black education has become an area of great public concern in South Africa. Unfortunately however, economists have not been able to provide much guidance to educational planning in this respect. One of the main reasons for this has been the recognition by economists that there are several impacts from education which are not easily incorporated into a purely economic analysis. But this should not be seen as an excuse for abandoning the analysis of the economic impacts of education. What it does suggest , is a need for a broader, more flexible framework within which the economic impacts may be seen in perspective - a framework such as the one developed in this thesis.

In spite of the advantages of a clearer perception of the consequences of education, which may be expected to arise by considering its economic impacts within such a framework, the techniques available for an analysis of these impacts are only capable of yielding imprecise results, especially from a quantitative point of view. In the case of South Africa, even allowing for limitations in the techniques, it would appear that their potential for application is far from being realized, a fact which may be attributable to a lack of recognition that many of the limitations inherent in the techniques can be diminished by the incorporation of various refinements. In this connection (see chapter 1), it was shown that considerable adjustment was indeed possible in CBA applications in order to achieve greater accuracy in social calculations, although admittedly, as with almost any economic study, it was necessary to conclude that the results of the analysis remained tentative.

In the particular field of the application of CBA to education (rate-of-return analysis), the techniques of manpower planning and statistical estimation of earnings functions were considered alongside the CBA approach. But while neither proved to be a substitute for CBA, they did seem to offer the potential for

yielding complementary insights.

Manpower planning involves the forecasting of demand for "educated" labour whereas rate-of-return analysis is almost entirely an ex post assessment. Thus the advantage of manpower planning is that it can accommodate considerable shifts in the demand for educated manpower, where these may be expected, whilst rate-of-return analysis is mainly a guide to marginal considerations, such as the "fine-tuning" issues discussed in chapter 4.

In CBA, earnings differences are used to estimate the rates of return to different levels and types of education. The background to this exercise is provided by human capital theory. In fact, it was shown in chapter 2 that one could directly calculate rates of return to education by the estimation of human-capital earnings functions - this being an alternative approach to CBA. One great advantage of the earnings function approach discussed, was that other determinants of earnings such as ability and socio-economic status could be incorporated, and as a result of the estimation of these types of earnings functions, the differences in earnings attributed to education alone could be calculated. This made it possible to establish a concept such as the alpha coefficient, by which earnings differences are to be deflated in order to remove the effects of ability and socio-economic status. Yet all this remains a matter of debate, as set out in chapter 2.

In the review of relevant studies done in South Africa (see chapter 3), it was found that nothing definite could be concluded from them about the economic impacts of Black education. The views of some writers in this regard, were that this state of affairs arose out of the socio-political dispensation in South Africa. Be that as it may, the prevailing socio-political system should not be used as an excuse for failing to apply available techniques to the economic impacts of Black education. In view of the rather unsatisfactory nature of the few empirical studies which have been conducted in South Africa in this field, it certainly seems premature to take an overly critical view of CBA and related techniques and to conclude that they have no useful

application to Black education. It would appear that the rejection of economic analysis on the basis of the socio-political system in South Africa is partly the outcome of a failure to see the economic implications of education in an overall framework.

The main conclusion in this thesis is that empirical analysis per se, does not confirm at the present time the need for a massive expansion programme in Black education without qualification. This tentative conclusion should however, be seen against a background where the opportunities for analyzing the costs of and benefits from education in South Africa have not yet been fully exploited. Moreover, socio-political discrimination may well serve to depress rates of return to Black education. The guiding principle to emerge from the model, developed here on the provision of education to the Blacks in South Africa was that this should not simply be a matter of "catching up with the Whites", but rather one which takes into account the background appropriate to their own socio-economic development needs.

BIBLIOGRAPHY

Arrow, K.J. Social choice and individual values. (Second Edition). New York, Wiley, 1951.

Arrow, K.J. and Lind, R.C. "Uncertainty and the evaluation of public investment decisions", American Economic Review, Volume 60, June 1970, p. 364-378.

Balogh, T. and Streeten, P.P. "The planning of education in poor countries", Economics of education, (Edited by Blaug, M.) Bungay, Penguin, 1971.

Bates, T. Aspects of the theory of human capital and its application to South African economic development. Unpublished Masters thesis, Rhodes University, 1973.

Becker, G.S. Human capital: A theoretical and empirical analysis with special reference to education. New York, Columbia University Press, 1964.

Becker, G.S. "Optimal investment in human capital", Investment in human capital, (Edited by Kiker, B.F.), Columbia, University of South Carolina Press, 1971, p. 2-12.

Ben-Porath, V. "The production of human capital and the life cycle of earnings", Journal of Political Economy, Volume 75, 1967, p. 352-365.

Berry, A. "Education, income, productivity and urban poverty" Education and Income, Washington DC, The World Bank, 1980, p. 157-230.

Blair, L.M., Finn, M.G. and Stevenson, W. "Returns to the associate degree for technicians", Journal of Human Resources, Volume 16, Number 3, 1981, p. 449-458.

Blaug, M. Economics of education 1. Bungay, Penguin, 1971.

Blaug, M. An introduction to the economics of education. London, Penguin, 1972.

Blaug, M. "The empirical status of human capital theory: A slightly jaundiced survey", Journal of Economic Literature, Volume 14, Number 3, September, 1976, p. 827-855.

Blaug, M. and Mace, J. "Re-current education - The new Jerusalem", Higher Education, Volume 6, Number 3, August, 1977, p. 277-299.

Botha, W. "Black education: Making dramatic strides year by year", Growth: Journal of Development in Southern Africa, Volume 2, Number 1, January, 1982, p. 9-12.

Bowles, S. and Gintis, H. "The problem with human capital theory - A Marxian critique", American Economic Review, 1975, p. 74-82.

Bowman, M.J. "The human investment revolution in economic thought", Sociology of Education, Volume 39, 1966, p. 111-138.

Bowman, M.J. "Education and economic growth: An overview", Education and income, Washington D.C., The World Bank, 1980, p.1-71.

Chiswick, C.U. "On estimating earnings functions for LDC's", Journal of Development Economics, Volume 3, 1976, p. 67-78.

Colby, D.,Ditzian, J. and Waxmonsky, R. "Determinants of Black wages: A case study", South African Journal of Economics, Volume 45, 1977, p. 243-267.

Colclough, C. "The impact of primary schooling on economic development: A review of the evidence", World Development Journal, Volume 10, Number 3, March, 1982, p. 167-185.

de Lange, J.P. (Commission). Provision of education in the RSA, Reports of the Main Committee, Finance Committee and Building Services Committee of the HSRC Investigation into Education, 1981.

Denison, E.F. The sources of economic growth in the United States and the alternatives before us. New York, Committee for Economic Development, January, 1962.

Due, J.F. Government finance: Economics of the public sector, (Fourth Edition). Homewood, Irwin, 1968.

Eckaus, R.S. "Investment in human capital: A comment", Journal of Political Economy, Volume 71, Number 5, 1963, p. 501-505.

Fields, G.S. "Education and income distribution in developing countries: A review of literature", Education and Income, Washington D.C., The World Bank, 1980, p. 233-315.

FitzGerald, E.V.K. Public sector investment planning for developing countries, London, MacMillan, 1978.

Freeman, R.B. "Overinvestment in college training?" Journal of Human Resources, Volume 10, 1975, p. 287-311.

Freeman, R.B. "The facts about the declining value of college", Journal of Human Resources, Volume 15, Number 1, 1980, p. 124-142.

Freiden, A.N. and Staaf, R.J. "Scholastic choice: An economic model of student behaviour", Journal of Human Resources, Volume 8, Number 3, 1973, p. 396-404.

Frisch, R. From utopian theory to practical applications: The case of econometrics. (Nobel memorial lecture). Stockholm, Nobel Foundation, 1970.

Graaff, J. de V. "Cost-benefit analysis: A critical view", South African Journal of Economics, Volume 43, Number 2, June, 1975, p. 233-244.

Griffiths, H.R. and Jones, R.A. South African labour economics. Johannesburg, McGraw-Hill, 1980.

Harberger, A.C. Project Evaluation. London, MacMillan, 1972.

Hicks, J.R. "Consumers' surplus and index-numbers", Review of Economic Studies, Volume 9-10, 1941-1943, p. 126-137.

Jallade, J.P. "Basic education and income inequality in Brazil", World Development Journal, Volume 10, Number 3, March, 1982, p. 187-197.

Jolly, R. and Colclough, C. "African manpower plans: An evaluation", International Labour Review, Volume 106, 1972, p. 207-264.

Joubert, R.J.O. "Verdienstefunksies en die onderwys", South African Journal of Economics, Volume 46, Number 4, December, 1978, p. 371-399.

Joubert, R.J.O. "Onderwys en economiese groei in Suid-Afrika", South African Journal of Economics, Volume 47, Number 2, June, 1979, p. 136-155.

Kaldor, N. "Welfare comparisons of economics and interpersonal comparisons of utility", Economic Journal, Volume 49, September, 1939, p. 549-552.

Keynes. J.M. The general theory of employment, interest and money. London, MacMillan, 1957.

Kiker, B.F. "Historical roots of the concept of human capital", Journal of Political Economy, Volume 74, Number 5, 1966, p. 481-499.

Kiker, B.F. "Marshall on human capital: Comment", Journal of Political Economy, Volume 76, September, 1968, p. 1088-1090.

Knight, J.B. and Sabot, R.H. "The returns to education: Increasing with experience or decreasing with expansion", Oxford Bulletin of Economics and Statistics, Volume 43, Number 1, February, 1981, p. 51-71.

Knudsen, O.K. and Servelle, P.J. "The demand for higher education at private institutions of moderate selectivity", The American Economist, Volume 22, Number 2, 1978, p. 30-33.

Layard, R. "Economic theories of education planning", Essays in honour of Lord Robbins,(Edited by Preston, M. and Corry, C.), London, Weidenfeld and Nicolson, 1972, p. 118-149.

Layard, R. and Psacharopoulos, G. "The screening hypothesis and returns to education", Journal of Political Economy, Volume 82, 1974, p. 985-998.

Little, I.M.D. A critique of welfare economics. (Second Edition). London, Oxford University Press, 1957.

Little I.M.D. and Mirrlees, J.A. Project appraisal and planning for developing countries. London, Heinmann, 1974.

Lockheed, M.E., Jamison, D.T. and Law, L.J. "Farmer education anf farm efficiency: A survey", Education and Income, Washington D.C., The World Bank, 1980, p. 113-152.

Lombard, J.A. (Editor). "Employment through education", Focus on key economic issues, Number 27, November, 1980.

Louw S.J.H. "Income, education and experience - A case study of non-Whites in South Africa", Development Studies on Southern Africa, Volume 1, Number 4, July, 1979, p. 391-415.

Louw, S.J.H. "An introduction to cost-benefit analysis as an element in project evaluation", Development Studies on Southern Africa, Volume 3, Number 2, January, 1981, p. 114-137.

Malherbe, E.G. Education in South Africa, Volume II, 1923-1975. Wynberg, Juta, 1977.

Marglin, S. Public investment criteria. London, Allen and Unwin, 1967.

Marshall, A. Principles of economics: An introductory volume. (Eighth edition) London, MacMillan, 1947.

Maslow, A.H. Motivation and personality. (Second Edition). New York, Harper and Row, 1970.

McMahon W.W. and Wagner, A.P. "Expected returns to investment in higher education", Journal of Human Resources, Volume 16, Number 2, 1981, p. 274-285.

McNabb, R. and Psacharopoulos, G. "Further evidence on the relevance of the dual labour market hypothesis for the U.K.", Journal of Human Resources, Volume 16, Number 3, 1981, p. 442-448.

Medoff, J.L. and Abraham, K.G. "Are those paid more really more productive? The case of experience", Journal of Human Resources, Volume 16, Number 2, 1981, p. 186-216.

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

Mingat, A. and Eicher, J.C. "Higher education and employment markets in France", Higher Education, Volume 11, Number 2, March, 1982, p. 211-220.

Mishan, E.J. "A proposal normalisation procedure for public investment criteria", Economic Journal, Volume 77, 1967, p. 777-796.

Mishan, E.J. Cost-benefit analysis: An informal introduction. London, Allen and Unwin, 1971.

Mishan, E.J. Economic efficiency and social welfare. London, Allen and Unwin, 1981.

Musgrave, R.A. The theory of public finance. Tokyo, McGraw-Hill, 1959.

Morgenstern, R.D. "Direct and indirect effects on earnings of schooling and socio-economic background", Review of Economics and Statistics, Volume 55, 1973, p. 225-233.

Ninth economic development programme for the Republic of South Africa: 1978-1987. A strategy for growth, Volume1. Pretoria, Office of the economic advisor to the prime minister, 1979.

Okedara, J.T. "Cost-benefit analysis of formal and non-formal education: a case study", Nigerian Journal of Economic and Social Studies, Volume 20, Number 1, March 1978, p. 89-110.

Papanicolaou, J. and Psacharopoulos, G. "Socio-economic background, schooling and monetary rewards in the United Kingdom", Economica, Volume 46, 1979, p. 435-439.

Pearce, D.W. Cost-benefit analysis, London, MacMillan 1971.

Pearce, D.W. and Nash, C.A. Social appraisal of projects: A text in cost-benefit analysis. Hong Kong, MacMillan, 1981.

Pigou, A.C. The economics of welfare. (Fourth edition). London, MacMillan, 1960.

Prest, A.R. and Turvey R. "Cost-benefit analysis: A survey", Economic Journal, Volume 75, December, 1965, p. 683-735.

Psacharopoulos, G. Returns to education: An international comparison. Amsterdam, Elsevier, 1973.

Psacharopoulos, G. "Return to education: An updated international comparison", Education and Income, Washington D.C., The World Bank, 1980, p. 75-109.

Psacharopoulos, G. and Layard, R. "Human capital and earnings: British evidence and a critique", Review of Economic Studies, Volume 46, July, 1974, p. 485-503.

Psacharopoulos, G. and Sanyal, B. "Student expectations and graduate market performance in Egypt", Higher Education, Volume 11, Number 1, January, 1982, p. 27-50

Riley, J.G. "Information, screening and human capital", American Economic Review, 1976, p. 254-260.

Rizzuto, R. and Wachtel, P. "Further evidence on returns to school quality", Journal of Human Resources, Volume 15, Number 2, 1980, p. 240-254.

Rumberger, R.W. "The economic decline of college graduates: Fast or fallacy?", Journal of Human Resources, Volume 15, Number 1, 1980, p. 99-112.

Sadie, J.C. "The social anthropology of economic underdevelopment", Economic Journal, Volume 70, June, 1960, p. 294-303.

Sadie, J.L. Planning for the economic development of Rhodesia. Salisbury, Government Printer, 1967.

Schultz, T.W. "Investment in human capital", American Economic Review, Volume 51, 1961, p. 1-17.

Schwartz, E. and Thornton, R. "Overinvestment in college training?", Journal of Human Resources, Volume 15, Number 1, 1980, p. 121-123.

Scitovsky, T. "A note on welfare propositions in economics", Review of Economic Studies, Volume 9, 1941, p. 77-88.

Smith, A. An inquiry into the nature and causes of the wealth of nations. (First Edition). London, Methuen, 1904.

Smuts, J.S. and Terblanche, S.S. The private rate of return on investment in education in the Republic of South Africa for 1960 and 1970. Pretoira, Institute for manpower Research, 1974.

Spence, M. "Job market signalling", Quarterly Journal of Economics, Volume 87, 1973, p. 353-374.

Squire, L. and Van der Tak, H.Q. Economic analysis of projects. Baltimore, John Hopkins, 1975.

Steenkamp, J.J.A. "Income and expenditure patterns of urban Black households in Port Elizabeth-Uitenhage. Pretoria, Bureau of Market Research (Unicesa), 1976.

Sugden, R. and Williams, A. The principle of practical cost-benefit analysis. Oxford University Press, 1978.

Surrey, M.J.C. An introduction to econometrics. Oxford, Claredon Press, 1974.

Taubman, P.J. and Wales, T.J. "Higher education, mental ability and screening", Journal of Political Economy, Volume 81, 1973, p. 28-55.

Thirlwall, A.P. Growth and development with special reference to developing economies. Bungay, MacMillan, 1972.

Toffler, A. Future shock. London, Bodley Head, 1970.

Vaizey, J. The economics of education. London, MacMillan, 1973.

Wallis, K.F. Introductory econometrics. London, Gray-Mills, 1972.

Welch, F. "The human capital approach: An appraisal: Human capital theory, education, discrimination and life cycles", American Economic Review, Volume 65, May, 1975, p. 63-73.

de Wet, G.L. "The state of cost-benefit analysis in economic theory", South African Journal of Economics, Volume 44, Number 1, March, 1976, p. 50-64.

Witmer, D.R. "Has the golden age of American higher education come to an abrupt end?", Journal of Human Resources, Volume 15, Number 1, 1980, p. 113-120.

World development report 1980. Washington D.C., Oxford University Press, 1980.