Methods for Project Evaluation Pretension and Redemption*

By Axel Sell

The main lines of several approaches for project evaluation are discussed. The points made are concerned with problems of logical consistency and with the question of whether the relevant aspects of the decision problem are included in the approaches.

I. Introduction

Market prices in LDCs are very often considered not to reflect the actual scarcity of resources for society. Given the large number of possible distortions in product and factor markets they are regarded as incorrect signals for decision-makers.

In the relevant literature, therefore, social cost-benefit analysis is offered as a method that should lead to better decisions in allocation problems. The net social benefit of a project in these approaches is computed by comparing social costs and social benefits, whereby in evaluating costs and benefits the objectives of society and constraints like scarcity of resources are considered.

It is a relatively new phenomenon that distributional and growth objectives of a society are explicitly referred to when computing the social prices of a project's output and the social prices of factor inputs. Such prices often are called "shadow prices".

The methods for project evaluation by cost-benefit-approaches are criticised in the relevant literature for different reasons. Following the classification of Stewart tackling the Little/Mirrlees approach we could distinguish second order criticisms — criticisms that are concerned with the details of the methodology — and first order criticisms. First order criticisms are directed at the principles behind social cost-benefit analysis (see *Stewart*, 1978, p. 154).

I do not want to describe some of the models for project evaluation in detail or to summarize the criticisms on these approaches. I assume

* This paper is part of a research project that is sponsored by the Deutsche Forschungsgemeinschaft (SFB 86, Hamburg/Kiel, Teilprojekt B 2).

that the basic lines of these models are well known and will mainly deal with questions neglected in the relevant literature.

The points I want to make are concerned with problems of logical consistency and with the problem of whether the relevant aspects of the decision problems are included in the approaches. According to the classification of Stewart, part II would be second order criticisms, and the parts III to V first order criticisms.

In the following I will deal with some of the main approaches in this field, which were developed under the sponsorship of International Organizations:

The UNIDO model developed by Dasgupta, Sen and Marglin, the OECD approach by Little and Mirrlees, and the World Bank model by Squire and van der Tak. In addition I will discuss briefly the "effects method", developed by Prou and Chervel, for it is stated "that the Little-Mirrlees method had been developed in part as a response to the effects method" (*Balassa*, 1976, p. 219).

It needs no further explanation that the computing of a consistent set of shadow prices would require a simultaneous solution of the allocation problem for all scarce factors for a given objective function of society.

However, all cost-benefit approaches in this field are far from a simultaneous solution of the allocation problem and a simultaneous determination of the shadow prices in a mathematical sense. Contrary to this, they deal with each factor in isolation paying special attention to resources dealing with exports or imports by deriving a shadow price for foreign exchange.

Although the models which we will deal with were developed originally especially for public projects, an extension to private projects has taken place.

II. Methods of Project Evaluation

1. General Remarks

The UNIDO-model, OECD-approach and the World Bank model in the relevant literature often are regarded as "one consistent body of appraisal" that "only differ in a few technical points of application" (*Hass-Hürni*, 1978, p. 70), a statement which is in line with those of other authors, stating that these models are identical in principle and only have different numéraires and other saving functions (*Lal*, 1974, p. 31; *Weiss*, 1976, p. 364; *Schmidt*, 1976, p. 153).

If these models were to form a consistent body of appraisal this would require that the important premises of these models be identical and not differ for different parts of the analysis. To discuss these problems we must have a look at the derivation of the shadow prices for the most important factors in these models, capital and labor.

2. The Shadow Price for Foreign Exchange

We will not discuss in detail the problem of the shadow price for foreign exchange for this point has been discussed elsewhere (see e.g. *Schäfer,* 1977; *Joshi,* 1972), only some short remarks have to be made.

As it is pointed out in the UNIDO-Guidelines there are two ways of viewing foreign exchange in the calculation of national economic profitability. "First, foreign exchange can be viewed simply as instrumental to aggregate consumption; the value of foreign exchange is then the amount of aggregate consumption that would be obtainable with a unit of foreign exchange. Second, foreign exchange earnings or savings can be regarded as a goal in themselves prized over and above their contribution to aggregate consumption" (ibid, p. 229). *Little / Mirrlees* use border prices of traded goods as "sheet-anchor" to reflect real opportunities open to the economy, and free foreign exchange of the government is their evaluation criterion. The prices of goods therefore are expressed in world market prices, whenever possible. Goods, that are not directly traded (nontraded goods) are split up as far as possible into their input components of traded goods, non-traded goods, and unskilled labor (see *Little / Mirrlees,* 1974, pp. 66 ff.).

To compare non-tradable and tradable goods, a "conversion factor" is applied, which is the equivalent of an exchange rate. Although in general a different "conversion factor" for each piece of goods should be applied, a standard conversion factor is supposed for groups of goods for simplifying the procedure. This idea is followed by the World-bank model, too (*Squire / van der Tak,* 1975, p. 130).

3. The Shadow Price for Capital

The theoretical background for deriving the shadow price for capital in the three models is similar, although formally different by using different numéraires for making different streams of costs and benefits comparable.

The shadow price for capital in these models has to fulfill two purposes:

1. the output of a project will be saved or consumed, where saving is considered to lead to investment. Since additional capital formation seems

to be an important political goal in LDCs, the output of a project that leads to investment is regarded as of greater value than consumption. To make investment comparable to consumption, an evaluation number for investment, the shadow price for capital, ought to be used.

2. Given a pool of resources available for investment, the resources required for a project would come out of alternative investment. The opportunity costs for investment, therefore, can be regarded as the flow of consumption lost by not selecting the next best project.

   One unit of investment, therefore, has to be reevaluated in consumption units by using the shadow price for capital.

a) The Shadow Price for Capital in the UNIDO-model

The UNIDO-model in the simplest case assumes that £ 1 of marginal investment yield £ q per year and the life of investment is assumed to be infinite. The present value of the aggregate consumption stream for this £ 1 would be $P^{inv} = \frac{q}{i}$, with i = social rate of discount.

In this formula it is assumed that the yield will be immediately consumed. If a fraction $s \cdot q$ $(0 < s < 1)$ is reinvested the present value of the entire stream of consumption becomes

$$P^{inv} = \frac{(1 - s)\, q}{i - sq} \qquad \text{for } i > sq \tag{1}$$

(see *Dasgupta, Sen* and *Marglin*, 1972, p. 177).

To compute p^{inv} the value for i, s and q have to be estimated for the economy.

The weighted sum of incremental aggregate consumption due to a project is given by

$$B^* = \sum_{t=1}^{T} \frac{B_t}{(1 + i)}\, t - \frac{q}{i} K_0 \,, \tag{2}$$

where B_t represents the incremental aggregate consumption or its equivalent, attributable to the project in year t, i is the time preference of society = social rate of discount $(i < q)$ and K_0 is the amount invested. q is defined as marginal productivity of capital and as return on marginal investment as well (*Dasgupta, Sen* and *Marglin*, 1972, p. 174), which is not very informative concerning the elements involved. In a later chapter (p. 206) q is named the direct social yield of capital and is computed as the incremental output : capital ratio corrected by the direct opportunity costs of labor.

If q is specified in this way this must have consequences for the interpretation of B_t, as well. B_t may not include the direct opportunity costs of labor, either, for otherwise the project's net present value B^* would be systematically overestimated.

b) The Shadow Price for Capital in the OECD-model

In the *Little / Mirrlees*-model the present value of a unit of investment relative to the current consumption generated by industrial employment is derived by similar considerations as in the UNIDO-model. A difference in these approaches is the assumption of *Little* and *Mirrlees* that by the year T society will be indifferent to increments in consumption and investment.

The shadow price denoted by s_0 becomes:

$$s_0 = \frac{(c - m)\, n}{i - r}, \tag{3}$$

with r = the uncommitted social income generated per unit of investment
n = extra employment of unskilled labor per unit of investment
c = consumption per wage-earner, arising out of wage-payments
m = the marginal productivity of labor in agriculture.

(1) and (3) are identical because q in the UNIDO-model is formally equal to the sum of r and $(c\text{-}m) \cdot n$ if it is a public project. Private consumption of capitalists in the case of private projects would not be regarded as a benefit at all (ibid, p. 194), and saving by the private sector would not be regarded as being as worthy as public income (ibid, p. 243).

To fill formula (3) there are no fewer problems than with formula (1). Whereas in the UNIDO-model a direct estimation of s and q seems to be suggested, *Little / Mirrlees* offer two ways of estimating s_0. "One is to formulate an economic model of the economy, and solve it for an appropriate objective function ... The other way of estimating s_0 is simply to make plausible assumptions about the relevant variables, without fitting them together to form a fully articulated economic model" (*Little / Mirrlees*, 1974, p. 256). It is clear that, given the solution of the model for the economy, the allocation problem would be solved and there would be no need to work any longer with the partial approach. The second procedure suggested, bases estimations of the average r on evidence of reinvestment by public sector projects, n on the basis of current observations and well informed guesses about future trends, and estimations of c and m likewise shall be based on current evidence (see *Little / Mirrlees*, 1974, p. 257).

c) The Shadow Price for Capital in the World Bank-model

In the World Bank model the shadow price for public income v is derived. The formula is formally nearly identical with (1). q is defined as a stream of output, measured in foreign exchange and, therefore,

the units devoted to consumption, are to be corrected by the consumption conversion factor β, this being the relevant ratio of border to domestic prices:

(4) $$v = \left[\frac{q - sq}{i - sq}\right] \Big/ \beta$$ (see *Squire* and *van der Tak*, 1975, p. 105).

To offset the tendency to overestimate implicitly in equation (4) a minimum estimate is suggested by assuming that there is no reinvestment so that (4) becomes

(5) $$v = \left[\frac{q}{i}\right] \Big/ \beta$$ (ibid. p. 106).

Although the formulae (1), (3) and (4) are very similar in structure there is a basic difference concerning the meaning of q, the marginal product of capital.

Other than in the UNIDO-model and the *Little / Mirrlees*-model that includes the term $(c\text{-}m) \cdot n$ in deriving s_0 here q seems to be taken only as a measure for the power of capital to generate a profit. The incremental net output/capital ratio in the economy is only used to estimate an upper limit for q. According to *Squire / van der Tak* the resulting number would be overestimated for at least two reasons: firstly the ratio computed from data on net investment and increases in net product is an average concept, whereas q is a marginal concept; and secondly the contribution of other factors of production would be neglected as well as that of technical progress (see *Squire / van der Tak*, 1975, p.111).

It is therefore suggested to rely on micro estimates and "where available, pretax profits net of depreciation in the industrial sector will provide a useful base on which to estimate q" (ibid).

It should be clear that q in this concept does not include benefits, such as the creation of additional jobs or labor-income. Objectives like the solution of the unemployment problem or income generation for the poor are not explicitly part of the analysis. Given the general claim of cost-benefit-analysis this is at least surprising and quite different from the other approaches discussed.

4. The Shadow Price for Labor

a) The Shadow Price for Labor in the UNIDO-model

The shadow price of labor in the UNIDO-model depends on two factors. "(1) the output forgone by moving workers from their previous employment to public-sector jobs and (2) the shift in the composition

of output from investment to consumption by the expansion of public-sector employment. The importance of the second factor in turn depends on the shadow price of investment, which in turn makes the shadow wage dependent on the social rate of discount" (*Dasgupta, Sen* and *Marglin,* 1972, p.152). In deriving the shadow price for labor it is supposed "that the cost of additional public-sector employment is financed in increased taxation of capitalists, which reduces their consumption and investment in the ratio $(1 - s^{cap}) : s^{cap}$" (ibid, p.206). Given these assumptions the shadow price w^* is computed as the reduction of the capitalists' consumption $(1 - s^{cap})\ w$, the future consumption lost because of the reduction of investment $(s^{cap} \cdot P^{inv} \cdot w)$, the direct effect of labor z, and — with a negative sign — the increase in consumption of the employees w, with w = wage rate.

The formula for w^* thus becomes

$$w^* = z + s^{cap}\ (P^{inv} - 1)\ w. \tag{6}$$

It is possible to include distributional goals into this formula by little change of algebra; so if the burden of employment expansion is entirely borne by capitalists, the shadow wage could be reduced by placing negative distributional weights on the present and future consumption losses of capitalists (ibid, p. 212). It is suggested by the authors that, strictly speaking, the given formulae are limited in applicability to the analysis of expansion of public-sector employment at the expense of private capital formation and capitalists' consumption. To apply these formulae to other projects that draw the resources from other use into the public sector, "it is necessary to assume that the Government's marginal rate of saving is the same as the marginal rate of saving of private capitalists, and that common marginal output : capital and labour : capital ratios obtain in the public sector and the private (capitalistic) sector" (ibid). As the authors confess "such assumptions must strike the reader as heroic, but it is unlikely that the data likely to become available over the next decade will allow much improvement over this assumption" (ibid).

From the presentation above we see that the assumptions are not in line with those used in the derivation of the shadow price of capital. When deriving the shadow price of capital the assumption seems to be valid that a fixed pool of investment exists from which resources can be drawn, whereas now we are confronted with the assumption of the UNIDO-model that additional labor must be financed by raising taxes for capital owners. Furthermore, this assumption that leads to a reduction of investment must also lead to a complementary reduction of employment, where the workers already receive a wage rate of w. This effect should be regarded too, when computing w^*.

Another problem arises when looking at the financial return of the projects. If we are dealing with public health projects for the poor and similar projects in other areas there is clearly no important financial return, if one at all. For all other projects we are confronted in the UNIDO-model with the problem of financing current input because the return of the project are dated later than the labor-costs. If these projects have a financial return later on we are only concerned with the problem of preliminary financing. This, in my mind, is fundamentally different from the other approaches discussed.

Another interpretation of this problem was given by *Harberger* (1977, p. 243) who was "puzzled by the Guidelines' treatment (pp. 205 to 207) of the effects of the employment of labor on the rate of saving" as well. Contrary to my interpretation he seems to prefer the interpretation "that capital would have directly earned the full wages bill ... had it not been for the hiring ... of additional labor" (ibid, p. 245). But this interpretation would not be very plausible because of the implications concerning the production functions of the economy.

b) The Shadow Price for Labor in the Little / Mirrlees-model

The computation of the shadow price for labor is analysed for the rates in the urban sector but the suggestions for handling rural labor are quite similar (see *Little / Mirrlees*, 1974, p. 289 ff.).

The shadow wage rate (SWR) is derived as

$$\text{SWR} = m + (c' - c) + \left(1 - \frac{1}{s}\right)(c - m), \text{ with} \tag{7}$$

m = marginal productivity of the wage earner
c' = additional resources devoted to consumption
c = consumption of the wage-earner
$1/s$ = social value of a unit of consumption, expressed in value of investment.

The first term of formula (7) "is the cost which is associated with providing the consumption level c but does not form part of that consumption level (transport costs from country to town, and urban overheads); and the last term is the cost of having an extra amount c-m committed to consumption" (ibid, p. 271).

Formula (7) can be rearranged as the more simple formula

$$\text{SWR} = c' - \frac{1}{s}(c - m) \ . \tag{8}$$

As opposed to the UNIDO-model, here we have to interpret the correcting term for the investment/saving-effect of additional employ-

ment as an alternative way to take account of the lower worth of consumption given the objectives of society. For the evaluation of a project by comparing costs and benefits there is clearly no difference whether parts of the yields of a project are subtracted or whether an addition to the costs of a project takes place. The present value will be unchanged if both methods are applied in a compatible manner.

c) *The Shadow Price for Labor in the World Bank-model*

In the World Bank-model the shadow price for labor is derived in a quite similar way as in the *Little / Mirrlees* approach. To explain the problem of the integration of efficiency and equity in project selection, *Squire* and *van der Tak* in a simplifying way assume "that a project lasts one year and results in a net increase of E in real resources available to the economy" (1975, p. 52).

The distribution of E among different groups can be examined by giving different values to the resources accruing to each group "in accordance with the appropriate concept of social welfare and summed to obtain the measure of the project's social worth" (ibid, p. 52).

In formula (9) E is split up into income for the private sector (C) and the public sector. Because of "the many distortions in the product and factor markets of less developed countries" it is suggested "to adjust C, the financial measure of the increase in consumption, to obtain its real resource cost" (ibid, p. 53).

With β being the adjustment factor, we may write

$$E = C \cdot \beta + E - C\beta. \tag{9}$$

If one unit of public income is taken as the numéraire, the value of one unit devoted to consumption is defined as ω expressed in the units of the numéraire. The net social benefit S then becomes

$$S = (E - C\beta) + C \cdot \omega \tag{10}$$

which can be transformed to

$$S = E - C(\beta - \omega). \tag{11}$$

Formula (11) according to *Squire / van der Tak* has the advantage "of separately identifying the efficiency benefits E" so that "the project economist-analyst can begin by estimating efficiency benefits as has been done in the past" (ibid, p. 54). When discussing this topic we first should mention that, given this formula and the value of E, for a lot of projects where it is only to decide whether to accept or to reject a project, there is no need at all to quarrel with the distributional

aspects. According to (11) a positive (negative) E must always lead to a positive (negative) S if the state's share is of equal sign.

Secondly, from the definitions given above it should be clear that a loss of private resources is only exactly balanced by an increase in public resources if β is no more than a measure for the difference between world market prices and domestic prices of consumer goods due to tariffs. The difference is then accrued by the state as income through tariffs. If β as stated by the authors should adjust C for the "many distortions in the product and factor markets", adjustment should take place for the inefficient production of consumer goods in protected markets, for income-distributional effects, etc.

In this case society would suffer a loss of benefits depending on the distribution of E among different groups.

The conclusion drawn by the authors concerning the shadow wage rate is to regard the second term at the right side of (11) as net social cost of an increased private sector consumption. In obtaining the net increase in resources, E, the efficiency costs of the factors used have to be netted out; thus, the social cost of the labor input can be defined as:

$$\text{social cost} = \text{efficiency cost} + C\,(\beta - \omega), \tag{12}$$

where efficiency cost is synonymous for the marginal product lost by drawing resources from other purpose. If the increase in consumption per worker is $\bar{c}$ (c in the World Bank terminology), the social price per worker is:

$$\text{social price} = \text{efficiency price} + \bar{c}\,(\beta - \omega)\ . \tag{13}$$

$\bar{c}$ is comparable to $(c - m)$ in the OECD-model. As was already mentioned above a serious disadvantage of the World Bank model is that using formula (11) and (12) means that the effects of the distortions in the product and factor markets others than just the effects due to tariffs are regarded as of equal value to society, as public income. There is therefore a need for procedures to net out these effects too in order to get a more correct indicator for the social value of a project.

5. The Discount Rate for Future Costs and Benefits

To make future costs and benefits comparable to present costs and benefits we have to discount them.

Within the UNIDO-model discounting is done with the parameter i, the social rate of discount, "the rate at which society's weight on incre-

ments to consumption declines over time" (*Dasgupta, Sen* and *Marglin,* 1972, p. 156).

Little / Mirrlees and *Squire / van der Tak* discount future costs and benefits with the so-called Accounting Rate of Interest (ARI), which practically has the nature of a target rate of return. The discount rate by *Squire / van der Tak* is defined "as the rate of fall over time in the value of the numéraire (public income measured in foreign exchange)" (*Squire / van der Tak,* 1975, p. 142). Another estimate of the ARI is to account "that rate of discount which balances the supply of and demand for public investible resources" (ibid, p. 114); the same suggestion is found in *Little / Mirrlees:* "As with all systems of project analysis, the ARI also acts as a cut-off, rationing the amount of investment to funds available" (*Little / Mirrlees,* 1974, p. 72).

As was shown when discussing the shadow wage rate and the shadow price for investment, a value-judgment concerning the time preference of society has to take place when computing the values for these variables also. It should be clear that the computing of the ARI is not independent of the shadow prices discussed and vice versa. This is demonstrated by the formulae defining these parameters by *Little / Mirrlees* (ibid, p. 135, 295, 299) and by *Squire / van der Tak* (ibid, p. 114). A discussion of this point will follow below.

III. Project Evaluation and the General Framework

1. The Link between Partial Project Evaluation and the Economy

One main problem of the approaches discussed is the consistent establishment of a link between the partial approach of project evaluation and the macroframework of the economy.

Following *Little / Mirrlees* (ibid, p. 66), with the decision to compute accounting prices the thesis has been denied that a simultaneous solution of the allocation problem would be possible. A similar view is given by *Bruno* dealing with the "question of whether shadow prices derived from economy-wide planning models can be used, at least in theory, as they were meant to be used — for public pricing policy and as signals for decentralized investment decisions". His conclusion is "that the experience in this respect is as yet very limited and quite far from the idealized textbook picture" (*Bruno,* 1975, p. 203). We must have these qualifying remarks in mind when interpreting the same author's statement: "Any reasonable project evaluation must have as its background some conceptual macroframework which could be spelled out as an optimizing model" (ibid, p. 207). *Bevan* and *Soskice* (1976, p. 209) state that "the *Little / Mirrlees* procedure is derived in the con-

text of an optimum plan, but makes the more realistic assumption that there are additional constraints on the Government's freedom of action".

The authors of the UNIDO-Guidelines are rather sceptical concerning the practical importance of their finding: "Benefit-cost analysis will ... for some time to come play the modest role of facilitating comparison and choice between similar kinds of projects within a single branch of the public sector, rather than the more ambitious role of determining the allocation of public-sector resources among branches or the even more ambitious role of determining the allocation of resources between the public sector and the private sector" (*Dasgupta, Sen, Marglin,* 1972, p. 243).

Concerning the question of how to compute practically the shadow prices, the way that generally seems to be preferred is given by *Little / Mirrlees* e.g. estimating s_0, namely "to make plausible assumptions about the relevant variables, without fitting them together to form a fully articulated economic model" (*Little / Mirrlees,* 1974, p. 256).

Westphal suggests multiprocess or sector investment planning models as "an intermediate position within the overall planning process, coming between economy-wide planning models and detailed, micro-analytic project design and evaluation" (*Westphal,* 1975, p. 299). Following formal decentralized planning procedures which are formally analogous to the decomposition methods (ibid, fn. 85), he outlines "an informal procedure for linking sector planning to economy-wide and project planning" (ibid). The main idea of this approach is outlined as follows: "The purpose of linking the various planning levels is to arrive at a mutually consistent set of quantitative allocation and shadow prices. Thus, the shadow prices of central resources (e.g. foreign exchange, investment funds, labor) and exogenous inputs are not taken as given in a decentralized planning exercise, though they are in any particular solution of a multiprocess model." (ibid, p. 229). Without discussing this approach any further, it should be clear from the discussion of the principle of decomposition that in the past the main purpose of this principle has been the use of computational advanages. This is a more technical point concerning the computational capacities and does not reduce the information needed within the system to reach the optimal solution and has no further advantages. The result of such an iterative procedure will be the same as that of a single numerically specified model. As in these formal decomposition procedures, the informal procedure outlined here cannot make a principle difference to an one-step-solution.

If, on the other hand, the intention of decomposition were to model some decentralized systems because of organizational aspects, we would

have to take into consideration the different objective functions of the decentralized units and differences to those of the society, "gaming" aspects within the iterative procedure, etc., problems that more recently got attention in business science (*Carleton* et al, 1974; *Schmidt,* 1978). Given the state of the art in this field, however, the reference to models working analogously to the decomposition principle is more an excuse than a real help. And indeed this conclusion is supported by the confession that "the procedure outlined above will lead to a reasonably efficient resource allocation if two conditions are satisfied:

(i) the choice of processes within the sector does not significantly influence the shadow prices of central resources; and

(ii) the exogenous demands stipulated in the sector model are consistent with the product shadow prices obtained in the sector model solution. Essentially, these conditions state that there must not be significant interdependencies between activity endogenous to the sector model and that in the rest of the economy" (*Westphal,* 1975, p. 300).

Given these conditions the problems have been defined away and clearly iterative procedures of the informal decomposition procedure are not necessary at all because the allocation of resources in one sub-model does not influence the other sub-models.

We therefore can conlude that there are no convincing hints as to how to derive a consistent set of shadow prices. References to optimizing models are not very promising, nor are hints on analogous procedures to the decomposition principle. Therefore, we have to live with the situation that shadow prices derived are "only a little better than a crude guess" like Little / Scott for example have found reviewing the computation of the rate of discount in case studies (*Little / Scott,* 1976, p. 5) .However, even a criteria to make us sure that these prices are at least "a little better" does not exist.

2. Project Selection with Shadow Prices and the State's Budget

The most important impact of project selection by shadow prices for the macro-level that should be taken into account is the problem of subsidies (see e.g. *Weckstein,* 1971/72, p. 484, 493). As *Little* and *Scott* say: "If shadow prices make any difference at all, they will lead to costs which are higher at actual prices (though lower at shadow prices) than they need have been, so customers will complain if charges are based on actual costs. Competitors, on the other hand, will complain of subsidization. The Ministry of Finance will also complain if it has to pay subsidies . . ." (*Little / Scott,* 1976, p. 10). Analyzing the practical

problem of implementing accounting prices for the Mauritius Port development project *Heggie* concludes: "What is quite clear is that accounting prices cannot simply be used for investment decisions, leaving the questions of pricing and financial management to look after themselves" (*Heggie*, 1976, p. 241). Unfortunately this is a point widely neglected in the relevant literature.

One way to avoid subsidies would be to reject projects which do not have a positive present social value and to accept only projects that have both a positive present social value and an acceptable rate of return at market prices (see *Little / Mirrlees*, 1974, p. 73). This solution would clearly raise the question of sub-optimizing.

Another way would be to let the accounting rate of interest act as a cut-off, rationing the amount of investment to the funds available (ibid, p. 72). To make this a handy solution we have to assume that the need for subsidies in the date of implementation or in future periods will not be important enough to raise problems for fulfilling the budget-constraint in each period. This solution seems to be offered by the World-Bank model as well (see *Squire / van der Tak*, 1975, p. 76). However, if there are important market distortions and thus there is a need for Cost-Benefit Analysis, the requirements for subsidies cannot be neglected in project selection.

From the discussion of the ARI we know that the value adjudged to it is not independent of the other prices of the system. A change due to budget constraints etc. must therefore have consequences for the value of the shadow wage etc. and we are practically referred to an iterative procedure of estimating all the relevant variables in a consistent manner agagin. Clearly within such a procedure the ranking of projects changes since the social benefit of every project would be affected by the change of the price system.

This point is not and cannot be regarded in case studies dealing with one single project, but this means that such studies can only by chance be in line with an overall financial constraint.

Even if looking at public projects only, we must have information on the budget requirement of every project in the future periods to make such a project work, not just the social profit and the amount of the initial investment. This is even more true if private projects are included, for indeed the approaches fail to address the question of how to influence the decisions of the decentralized decision makers. If market prices cannot be influenced directly, the only possibility for an internalization policy would be the development of a system of taxes and subsidies with consequences for the state's budget and most probably for the economic system as well. If e.g. subsidies are paid to

balance a deficit or if a bargain between enterprises and government takes place and this bargain is not "directly related to the shadow-price-market-price discrepancy, then the profit-loss incentive to efficient performance is destroyed" (*Weckstein*, 1971/72, p. 493).

IV. Another View of the Structure of the Models of Project Evaluation

One of the difficulties in discussing the above approaches and the differences between them is — as *Stiglitz* pointed out in connection with the UNIDO and the OECD-approach — that "the authors cover themselves for almost all contingencies ... And that is one of the reasons why in some of the discussions, one wonders whether or not there is actually a disagreement between them; 'everything' probably is in both books if you look hard enough. There is a difference regarding what has been stressed, a difference of emphasis" (*Stiglitz*, 1977 a, p. 84).

However, although it is respectable for the authors to refer themselves to some possible shortcomings of their approaches and to discuss some problems associated with the procedures offered, this clearly does not solve the problems and the hurried reader will get the impression that all problems mentioned by the authors have been taken into account in an appropriate manner.

It could therefore be useful to give a short sketch of the procedure actually followed by the models. We may split up the procedure into four steps.

Step 1: A numéraire and a pricing system for goods has to be found. In the Little/Mirrlees model e.g. the price system is given as far as possible by world market prices, reflecting "real opportunities open to the economy".

Step 2: An objective function for society has to be formulated. This objective function is one-dimensional and takes account of the different social value of saving and consumption, and the distributional effects according to groups. Hints are given as to which aspects should be regarded in computing weights.

Step 3: Shadow prices for non-tradable factors have to be computed. Indeed, only one scarce factor seems to exist in these models, namely capital. Thus in this simplified framework there is no need for a simultaneous solution offered by optimizing models, e.g. Linear-Programming models. For factors such as labor there are rough guesses suggested to estimate the marginal productivity (see e.g. *Little / Mirrlees*, 1974, p. 277). The inclusion of distributional aspects into the shadow-price formulae by the OECD-model and World-Bank model is merely a formal aspect. Systematically this aspect belongs to step 2, and is an adjustment of a project's contribution

to the objective function with the disadvantage that it makes the formulae of the shadow-price for factors look much more complicated.

Step 4: The question as to what happens when the financial requirements are in conflict with a budget constraint is not outlined "in adequate detail" (*Marglin*, 1977, p. 100) in the UNIDO-model. In both the other models discussed the ARI is used as an instrument to ration the amount of investment. Given the assumed possibility to compute the shadow prices of all the other resources independently from the ARI, projects with the greatest social value per unit capital could be selected. If too much or too little capital is required, an iterative procedure must take place. For the isolated evaluation of one project this suggestion clearly must be meaningless.

The above discussion has shown that the models focus mainly on step 1 and step 2. The tackling of the problems in these points is criticised in the relevant literature for reasons like the impossibility of measuring the various parameters, the lack of clarification of the influence of political value judgements on the result of the evaluation (see e.g. *Weiss*, 1976, *Amin*, 1978). Unfortunately step 3 is not outlined in a similar manner and the validity of the economic model that appears to underlie the models has been questioned by other authors. Alternative models, leading to quite different results which seem at least as plausible, have been developed (see e.g. for the labor market *Stiglitz*, 1977 a, p. 85, *Stiglitz*, 1977 b). Furthermore the bulk of public investment is done in the area of social overhead investment and therefore it has been questioned whether q as a marginal rate of return on public investment can be deducted at all (*Weiss*, 1976, p. 372).

Even if all these handicaps could be overcome or were not as relevant as the critics think them to be, the limited budget would require an iterative procedure in determining a set of projects that is accepted. The above statement would not be valid only in the case of the unprobable situation that the „correct" ARI is found in an one-step shot.

The information given by the social value of a project is not sufficient for such a procedure, additionally the financial requirements of a project — inclusive of subsidies of private projects — must be known.

V. Differences to the "Effects Method"

The information needed to solve the problem discussed is partly collected by the so called "effects method" developed by *Prou* and *Chervel* (1970). This method suggests a comparison of the situation with and withouth the project to estimate the total effect of the

project upon the economy, and a breaking down of the extra value added by category of agents who benefit. The project can then "be characterized by the plus or minus supplements or income it enables to be distributed to employees, ..., to the State and to entrepreneurs" (*Chervel,* 1974, p. 8). For the study of the effects of a project, an input-output analysis is suggested, if data are available. In contrast to the models discussed above, *Prou* and *Chervel* use market prices and not shadow prices, but this is merely a question of terminology and not a basic difference to the other models as we will demonstrate.

The total effect of a project is given by the extra value added by doing the project, and this extra value added is equal to the gain in foreign exchange. If we e.g. look at an import substitution project where the same product is placed on the market at the same price as before, in the case of underemployment the additional value added is given by the difference of the value added and the tariffs the state levies, or could have levied (see *Chervel,* 1974, p. 8). By this *de facto* a similar effect is achieved as with the computation of a shadow rate for foreign exchange in the other models discussed (for a discussion of some differences see *Chervel,* 1976, p. 338; *Balassa,* 1976 II, p. 351). Furthermore, a different evaluation of the extra value added according to category of agents is suggested (*Chervel,* 1974, p. 9; *Prou* and *Chervel,* 1970, p. 228 ff.) so that formally the remaining important difference to the above models is that the benefits are adjusted in a direct way according to the objective function, and are not transformed in elements of shadow factor prices. Therefore, the discussion of the "effects method" by *Balassa* (1976) is somewhat misleading. *Prou* and *Chervel* indeed decry the use of shadow prices as stated by *Balassa* (p. 227): "L'obstacle qu'oppose au calcul économique l'existence de prix trahissant les raretés relatives des produits est si grand qu'aucune recette simple ne permet de le surmonter" (*Prou* and *Chervel,* 1970, p. 3). But from the discussion of the other models it has become clear that these models do not compute shadow prices in the sense of a simultaneous optimizing model either, but use this term for primary factors only because of an indirect adjustment of the objective function. Even so the following statements give a wrong impression, namely that "the effects method makes no allowance for the opportunity cost to the national economy of productive factors other than capital, such as labour and land" (*Balassa,* 1976, p. 226), and that "this method is incorrect, however, because it identifies benefits to income recipients with the incomes they derive from the project without considering alternative possibilities open to them" (ibid, p. 230, similarly *Balassa,* 1977, p. 353). However, the formulation of the "effects method" is more general in nature and does not depend on the assumption that the

marginal product of the other factors would be zero if the project were not done. This assumption might be approximately true for the examples given by *Prou* and *Chervel* (ibid, p. 191 ff.), but it should be fair to mention that the authors themselves give an example how to deal with other cases (ibid, p. 192). Furthermore, *Chervel* is right in saying that the case studies contained in the UNIDO-guidelines and in the *Little / Mirrlees* book seem to consider output forgone, to be zero, as well (*Chervel,* 1977, p. 340).

Summary

In the present paper the main lines of three approaches for project evaluation have been discussed and the existence of differences between these approaches and some inconsistencies within these models have been demonstrated in Part II. As it was demonstrated for the computation of the shadow price of investment, the World-Bank model only regards future profits, created by additional investment, as relevant for the evaluation procedure whereas the UNIDO-guidelines and the OECD-approach explicitly refer to additional labor income or extra employment of unskilled labor as a benefit. To regard profit as a proxi for indirect effects on other income-categories would require many pre-conditions that will be fulfilled only by chance.

In computing the shadow price of labor, the UNIDO-model in opposition to both the other models seems to refer to the problem of preliminary financing of the input-factor labor, whereas the formulae for the shadow wage rates in the other models reflect mainly an adjustment for the different social value of income according to categories of agents and their probable disposition of the income.

Given the claim to be a response to other methods like the effects method and to show "how a whole set of accounting prices can be systematically and logically estimated and applied" (*Little / Mirrlees,* 1974, p. 37) the suggested evaluation procedures are somewhat disappointing, as was shown in Parts III to V. The problem of determining shadow prices of production that reflect the relative scarcity of the factors of production and their interaction are widely neglected and rough rules of thumb are suggested for estimation.

As *Chervel* has pointed out this is not a secondary matter but the crux of the matter. "Treating this problem hastily and disposing of it in a few pages amount to treating the problem of project appraisal and selection in exactly the same manner" (*Chervel,* 1977, p. 340). However it is true that these points are also not dealt with in detail in the

presentation of the effects method by *Prou* and *Chervel*, 1970, and *Chervel* and *Le Gall*, 1976, (see *Balassa*, 1976 II, p. 349).

A difference between the effects method and the other methods discussed, therefore, is mainly given by the fact that *Prou* and *Chervel* refuse to transform adjustment of the net benefits into elements of "shadow prices" and that they do not give hints as to how to value the benefits of specific groups, inclusive the State with tax-income, etc. Given the need for an iterative procedure to compute the ARI in the World Bank model and the OECD approach there is, formally, not a great difference to the suggestion of the effects method to use a ratio of extra value added and the capital requirement as a selection criterion for projects (see *Prou / Chervel*, 1970, p. 233 ff.; *Chervel*, 1974, p. 9 f.). Furthermore, if there is a budget constraint and the need for an iterative procedure to reach the final set of selected projects, the computation of shadow prices in the described manner is neither necessary nor helpful. The use of the terminology 'shadow price' in this connection might only lead to confusions with this term in simultaneous optimizing models and could give rise to the impression that the shadow prices in these models were equally computed under considerations of relatively scarcity and interactions of these factors.

Summary

The main lines of several approaches for project evaluation, recommended by certain International Organizations have been discussed and the existence of significant differences between these approaches and some inconsistencies within these models have been demonstrated. Given the claim of these models to be a response to other methods, such as the effects method, and of showing how a whole set of accounting prices can be systematically and logically estimated and applied, the suggested evaluation procedures are disappointing. Furthermore, if there is a budget constraint and the need for an interative procedure, then the computation of shadow prices in the described manner is neither necessary nor helpful to obtain the optimal set of projects.

Zusammenfassung

Die Diskussion einiger mit den Namen internationaler Organisationen verknüpfter Projektbewertungsmethoden zeigte bemerkenswerte Unterschiede zwischen diesen Methoden sowie Inkonsistenzen innerhalb der Modelle auf. Der Anspruch der Modelle, eine Antwort auf andere Ansätze wie die Effects-Methode zu sein und zu zeigen, wie in logischer und systematischer Weise Schattenpreise bestimmt werden können, wird nicht eingelöst. Soweit Budgetbeschränkungen zu beachten sind und ein iteratives Verfahren zur Bestimmung der Schattenpreise erforderlich wird, sind die auf die empfohlene Weise bestimmten Schattenpreise weder notwendig noch hilfreich für die Auswahl von Projekten.

References

Amin, G. A. (1978), Project Appraisal and Income Distribution, World Development 6, No. 2, 139 - 152.

Balassa, B. (1976), The 'Effects Method' of Project Evaluation, Oxford Bulletin of Economics and Statistics 38, 219 - 231.

— (1977), The 'Effects Method' of Project Evaluation Once Again, Oxford Bulletin of Economics and Statistics 39, 345 - 353.

Bevan, D. L. and D. W. *Soskice* (1976), Appraising Tourist Development in a Small Economy, in: Using Shadow Prices, ed. by I. M. D. Little and M. FG. Scott, London, 205 - 229.

Bruno, M. (1975), Planning Models, Shadow Prices, and Project Evaluation, in: Economy-Wide Models and Development Planning, ed. by. C. R. Blitzer, P. B. Clark and L. Taylor, Oxford University Press, London, 197 - 211.

Carleton, W. T., K. *Glen* and T. *Sanjiv* (1974), Application of the Decomposition Principle to the Capital Budgeting Problem in a Decentralized Firm, Journal of Finance, 815 - 827.

Chervel, M. (1974), Project evaluating by the "effects" method in developing countries, Industrialization and Productivity, Bulletin 20, 5 - 10.

Chervel, M. and M. *Le Gall* (1976), Manuel d'Evaluation Economique des Projects; La Methode des Effects! Paris.

Chervel, M. (1977), The Rationale of the Effects Method: A Reply to Bela Balassa, Oxford Bulletin of Economics and Statistics 39, 333 - 344.

Dasgupta, P., A. *Sen* and S. *Marglin* (1972), Guidelines for Project Evaluation, (UNIDO Wien) United Nations, New York.

Harberger, A. C. (1977), On the UNIDO Guidelines for Social Project Evaluation, in: Social and Economic Dimensions of Project Evaluation, Proceedings and Papers of the Symposium on 'The Use of Socioeconomic Investment Criteria in Project Evaluation', held at the Inter-American Development Bank on March 28 - 30, 1973, ed. by H. Schwartz and R. Berney, Washington D.C., 227 - 253.

Hass-Hürni, B. (1978), Methods of Project Appraisal and Their Applicability in World Bank Projects, Schweizerische Zeitschrift für Volkswirtschaft und Statistik 114, 69 - 78.

Heggie, I. G. (1976), Practical Problems of Implementing Accounting Prices, in: Using Shadow Prices, ed. by I. M. D. Little and M. FG. Scott, London, 230 - 246.

Joshi, H. (1972), World Prices as Shadow Prices: A Critique, in: Symposium on the Little-Mirrlees Manual of Industrial Project Analysis in Developing Countries, Bulletin of the Oxford University Institute of Economics and Statistics 34, 53 - 72.

Lal, D. (1974), Methods of Project Analysis: A Review, Baltimore and London.

Little, I. M. D. and J. A. *Mirrlees* (1974), Project Appraisal and Planning for Developing Countries, London and Edinburgh.

Little, I. M. D. and M. FG. *Scott* (1976), Introduction, in: Using Shadow Prices, ed. by I. M. D. Little and M. FG. Scott, London, 1 - 11.

Marglin, S. A. (1977), Discussion (on the UNIDO Guidelines), in: Social and Economic Dimensions of Project Evaluation, Proceedings and Papers of the Symposium on 'The Use of Socioeconomic Investment Criteria in Project Evaluation', held at the Inter-American Development Bank on March 28 - 30, 1973, ed. by H. Schwartz and R. Berney, Washington, 99 - 105.

Prou, C. and M. *Chervel* (1970), Etablissement des Programmes en économie sous-développée, Tome 3, L'étude des grappes de projets, Paris.

Schäfer, W. (1977), Wechselkursschattenpreise in Projektevaluierungen, unveröffentlichte Habilitationsschrift, Kiel.

Schmidt, K. (1976), Projektplanung — Intertemporale Konsumallokation und Cost-Benefit-Analyse für Entwicklungsprojekte, Bern und Stuttgart.

Schmidt, R. (1978), Zur Dekomposition von Unternehmensmodellen. Zeitschrift für Betriebswirtschaft 48, 949 - 966.

Squire, L. and H. G. *van der Tak* (1975), Economic Analysis of Projects. A World Bank Research Publication, Baltimore and London.

Stewart, F. (1978), Social Cost-Benefit Analysis in Practice: Some Reflections in the Light of Case Studies Using Little-Mirrlees Techniques, in: World Development 6, No. 2, 153 - 166.

Stiglitz, J. E. (1977 a), Some Further Remarks on Cost-Benefit Analysis, in: Social and Economic Dimension of Project Evaluation, Proceedings and Papers of the Symposium on 'The Use of Socioeconomic Investment Criteria in Project Evaluation', held at the Inter-American Development Bank on March 28 - 30, 1973, ed. by H. Schwartz and R. Berney, Washington, 83 - 94.

— (1977 b), Some Further Remarks on Cost-Benefit Analysis, in: Social and Economic Dimensions of Project Evaluation, Proceedings and Papers on 'The Use of Socioeconomic Investment Criteria in Project Evaluation', held at the Inter-American Development Bank on March 28 - 30, 1973, ed. by H. Schwartz and R. Berney, Washington, 253 - 282.

Weckstein, R. S. (1971/72), Shadow Prices and Project Evaluation in Less-developed Countries. Economic Development and Cultural Change 20, 474 - 494.

Weiss, D. (1976), Bewertungsprobleme bei der Analyse von Entwicklungsprojekten. Zeitschrift für Wirtschafts- und Sozialwissenschaften, 357 - 379.

Westphal, L. E. (1975), Planning with Economies of Scale, in: Economy-Wide Models and Development Planning, ed. by C. R. Blitzer, P. B. Clark and L. Taylor, Oxford University Press, London, 257 - 306.