World Bank project appraisers have been for some time among the most extensive practitioners of social or economic cost-benefit accounting. The vastly expanded attention of many economists in recent years to the conceptual foundations and the art of social cost-benefit accounting is, therefore, a welcome and challenging development to the Bank. It is hoped that the current debate over methodology will lead to a better understanding of what constitute socially beneficial projects and to a wider application of the advocated procedures.

The purpose of this paper is to expose and critically compare the main appraisal methods advocated in recent years. The author concludes that in principle most of the suggested methods are equivalent, given the same basic assumptions about the economic environment. The paper was written primarily for the operationally occupied economist. Persons wishing to pursue the subject in depth are referred to more technical works. While there will undoubtedly continue controversy over important differences of detail, the present paper is made available now for it presents a comprehensive survey of the major issues. Bela Balassa, David Henderson, Maurice Scott and Shlomo Reutlinger reviewed the first draft of this paper prepared in March 1972. The paper was also discussed at the series of IBRD seminars on Project Evaluation in October 1972 and comments made by members of this seminar were very useful. However, more than is usual, the disclaimers of their responsibility for the views expressed in the paper apply.

Deepak Lal, Consultant
Rural Development Division
Development Economics Department
IBRD, Washington, D. C., and
University College, London
ALTERNATIVE PROJECT SELECTION PROCEDURES
FOR DEVELOPING COUNTRIES:

A Critical Survey Without Tears

Deepak Lal

Consultant
Rural Development Division
Development Economics Department
IBRD, Washington, D.C., and
University College, London

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Preface

The following paper was written whilst working as a consultant to the World Bank. The first draft was completed in March 1972, and subsequent drafts were prepared following extensive and detailed comments from the following: Ánela Balassa, David Henderson, Maurice Scott and Shlomo Reutlinger. The paper was also presented at the series of IBRD seminars on Project Evaluation in October 1972, and the comments made by the members of the seminar were also very useful. However, more than is usual, the disclaimers of their responsibility for the views expressed in this paper apply.

Washington, D. C. Deepak Lal
Alternative Project Selection Procedures for Developing Countries

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1. The purpose of this paper is to compare and critically evaluate various alternative project selection procedures which have been put forward, particularly for application in less developed countries. It is meant primarily for the operationally occupied economist who may be confused by the various brand names, as well as the esoteric and highly charged claims and counter claims made by the proponents of the different methods, and who, moreover, may want to learn how the different methods fit in with economic theory as well as their own immediate practical preoccupations.

A. Some Preliminary Theory

2. It is appropriate to begin by stating the obvious: cost-benefit analysis is undoubtedly the most used, and arguably the most useful, form of applied welfare economics. Its theoretical basis as well as its limitations are therefore necessarily those of its parent, theoretical welfare economics. This paper is not for the theoretical purists, but for those who whilst recognising the limitations of theoretical welfare economics nevertheless feel that in our present state of knowledge it provides the only basis for making an economic assessment of investment plans and proposals.

3. The purpose of any project selection procedure must be to provide a decision rule for accepting or rejecting a project. The net present value (NPV) or the internal rate of return (IRR) of the project are the indices usually used. Our chief concern in this paper will be with first,
what should be included is a time stream of benefits and costs; secondly, what are the relevant values of the various cost-benefit components; and thirdly, how the discount rate (or rates) needed for determining the NPV, or the cut-off IRR at which projects are accepted, should be chosen. Most of the differences in the alternative procedures relate to apparently differing prescriptions in these three respects.

It will be repeatedly emphasized in this paper that any substantive differences among the alternative procedures are in large part dependent upon differing assumptions about the relevant aspects of the economic environment in which the investment decisions are being made. One of the basic purposes of this paper will be to demonstrate that, in principle, most of the suggested procedures are equivalent, if the same assumptions are made about the economic environment, though naturally there are differences in emphasis as to which set of assumptions is more relevant for LDC's in general, and more importantly in the practical problems of estimating the relevant values to be included in the NPV/IRR index, with accuracy and ease.

The reason why in principle most of the methods are equivalent, given the same basic assumptions about the economic environment, is their common lineage -- theoretical welfare economics. One of its basic results is that in a perfectly competitive economy (with no uncertainty about future tastes and technology), allocation of resources on the basis of market prices of goods and factors (for which markets exist) would result in
Pareto optimality for a given income distribution. Market prices of goods and factors would equate and equal the marginal social cost (MSC) of producing and the marginal social value (MSV) of using the relevant goods/factors. For a truly marginal investment project (in the sense that it does not alter the MSV and MSC's of the output it produces and inputs it uses as a result of its operation), the values of the output and inputs at market prices would provide the correct values to be used in determining the net present value of the project. Market prices would be the 'shadow' prices to be used in project selection.

6. If the investment project being considered is not marginal (or if there are externalities), and does affect the MSV and MSC's of its output and inputs, then the relevant measures of the social benefits and costs of the project will be the change in the consumer's and producer's surpluses.

\[1\] Pareto optimality necessitates that for a given distribution of income:

(i) the marginal rates of transformation in production of different commodities are equal to their marginal rates of substitution in consumption,

(ii) the marginal rates of substitution between any pair of factors are the same in all the industries in which they are used,

(iii) the marginal rates of substitution of any pair of commodities be the same for all individuals consuming both goods.

Given that the above conditions hold, a Pareto optimum will exist, such that for the given income distribution it will not be possible to make one person better off without making someone else worse off. Treating the same physical commodity at different dates as many different commodities, equivalent inter-temporal marginal equivalences for an efficient inter-temporal program can be desired. See \[8\].

\[2\] The net benefits being discounted at the optimal discount rate which equates the marginal rate of transformation (mrt) in production of present into future consumption, to its marginal rate of indifferent substitution (mrs) in consumption, determined in a perfect market for intertemporal consumption.
caused by the project. This, in principle, will be the procedure recommended by all the project selection procedures we shall consider. In the case of the perfectly competitive model, valuation of the changes in producers and consumers' surpluses, at market prices, will provide the correct indication of the net social benefits of the project.

7. To the extent, however, that the perfectly competitive paradigm does not hold -- for example due to the existence of monopolies, taxes and subsidies, externalities, and/or increasing returns -- market prices will no longer indicate the social costs and benefits of using and producing different commodities. The social cost to be included in the NPV/IRR index of social profitability, properly defined, will still be the marginal social cost of the various inputs used, and the social benefit will be the marginal social value of the output produced. However, the breakdown of the perfectly competitive assumptions results in market prices no longer equating and equalling the MSC and MSV of the relevant commodities. The market price will now equal either the MSV or MSC -- and in some cases of rationing may not equal either. The problem then is to adjust the market price to obtain the relevant 'shadow' prices, which are therefore generally needed in investment appraisal because of the divergence between the MSC and MSV of the relevant commodities.

8. If neutral fiscal devices (lump-sum taxes and subsidies) are feasible, then a full Pareto optimum could still be achieved if the government eliminates the divergence between MSC and MSV by suitably corrective tax-subsidy measures, thereby restoring the equivalence of MSC and MSV with the market price of the commodity. However, for obvious reasons it will not be possible, in most cases, to cure the divergence in this manner. In that case, the divergence between the MSC and MSV of the
commodity may have to be taken as a datum (or a constraint) and the 'shadow' prices corresponding to this constrained (or 'second-best') welfare optimum will need to be computed. A large number, if not most, of the shadow prices which we shall consider are of this 'second-best' kind.

9. Secondly, even if the government can eliminate the divergence between MSC's and MSV's by suitable tax-subsidy policy, it may take time for the divergence to disappear. Then current market prices will not equate the MSC and MSV of the relevant commodities, but it is expected that future market prices will. As investment takes time and its effects are extended into the future, it is clearly the MSC's and MSV's of the relevant inputs/outputs appropriately dated which will be relevant in working out the project's social profitability. If it appears likely that in the future an existing divergence between MSC and MSV will be corrected, the appropriately dated price which reflects the social cost/benefit of the project will not be the current market price, nor the current MSC and MSV of the commodity, but rather the 'equilibrium' price which is expected to prevail in the future. In this sense, even when an economy is moving towards an optimal set of market prices, from a distorted current set, it may be necessary to use 'shadow' prices corresponding to the future optimal market prices, rather than the current market or shadow prices for pricing inputs and outputs which form the time stream of benefits and costs of the investment project.

10. Third, even for a perfectly competitive economy, there will be different Pareto optima associated with different income-distributions. Judging between these different Pareto optima will necessarily involve normative judgments about the desirability of particular income
Even if agreement can be reached on the desired income-distribution, there will still be the problem of legislating this 'optimal' distribution. Again if neutral fiscal devices in the form of lump-sum taxes and subsidies are feasible, the government would be able to achieve a Pareto optimum with the optimal distribution of income. If however, as is more likely, neutral fiscal instruments are not available, then the distributional effects of investment projects will also have to be computed, and judged against and along with their purely efficiency effects. These problems open up other areas where there may possibly be conflicting judgments, and hence prescriptions for project selection procedures.

3. Practical Problems

These theoretical problems are compounded by practical ones. First, though there may be agreement that the correct prices to use in project selection must represent the MSV and MSC of the relevant commodities, there may be disagreement as to whether or not existing divergences will continue into the future or whether they will change. Depending on what assumption is made about the future course of the economy, the 'second-best' or 'first-best' shadow price will be the relevant one to choose. In a

1/ It being noted that investment projects affect both the intratemporal as well as the intertemporal distribution of income; the former by the distribution of their net benefits amongst contemporaries at a point in time, and the latter by the distribution of net benefits as between generations, over a period of time.

2/ The second best shadow price is that associated with continuing divergences, the next best, that with no divergence, between MSV and MSC.
sense, this is an empirical question; but to the extent that future
government policies are normally unknown, the element of judgment involved
in deciding which of these alternative assumptions is relevant, when
considering existing distortions in commodity and factor markets, will be
of paramount importance in deciding which is the correct 'shadow' price to
use. Hence it is important to remember that differing prescriptions on
alternative evaluation procedures will most often be due to differing
implicit assumptions about the current, or more importantly, the future
economic environment.

12. Secondly, though we have been discussing the evaluation of a parti-
cular project and the social valuation of its inputs and outputs in what may
appear to be a partial equilibrium framework, in principle, any proper
investment criteria must take account of the total (direct and indirect) or
general equilibrium effects of the investment project. The MSC's and MOC's,
which are taken as the 'shadow' prices in determining the social profitability
of the investment project, must therefore be the general equilibrium 'shadow
prices.' This might appear to be an impossible task, but the relative merits
of alternative investment appraisal procedures will depend upon their success
in taking account of the general equilibrium effects of projects, which will
in turn, if the procedures are to be practical, necessitate making certain
simplifying assumptions about the economic environment. Once again, these
assumptions, though empirical in nature, require judgment, and hence there

1/Th... for instance if an industrial project employs some seemingly
underemployed labour in the urban sector, the ultimate effects via the
impact on a rural-urban migration could be a significant change in
total output of the economy. The shadow wage rate will then in this
case have to incorporate both the direct and indirect (via migration)
effects of increasing industrial employment. See Section II-3 for a
more detailed discussion.
can be disputes as to whether or not the simplifying assumptions are 'realistic' and/or relevant.

13. For all the above reasons, even though all the procedures we will consider start from the same theoretical foundations, and hence are identical if equivalent assumptions are made, they will differ to the extent that, in practice, they emphasize one set of assumptions about the economic environment rather than another. Hence, the continuing charges and counter-charges that a particular procedure has ignored or assumed away an important aspect of reality, and is hence invalid; as well as the impression conveyed to neutral observers of shadow boxing on the part of different protagonists, and bafflement at the conflicting claims and counter-claims that are made for different procedures. This, however, does not imply that in practice certain procedures are not more general and easier to apply than others. However, it may be more important to begin by realising that the similarities amongst the procedures are far greater than the differences.

C. The Procedures

14. There are three main evaluation procedures (with different variants) which are really in the running for adoption by policy makers.1/ Those are (1) the system suggested by OECD [27] (or 'ain aspects of which are common to the procedures recommended by Harberger [11, 12, 13] and other writers on the subject [27], (2) the procedure suggested in the OECD Manual by Little and Mirrlees [247], and (3) the procedures associated with the names of Bruno [27] and Kruger [157].

1/ Later in Section I, it is shown that the Bruno-Kruger measure is really a variant of the shadow exchange rate methods, and hence there are really two procedures.
As these procedures all relate to ways of adjusting or correcting market prices, the best way to compare them is in relation to the important distortions which exist in most economies and the adjustments they suggest should be made in arriving at the 'shadow' prices which take account of these distortions. The following sections of the paper will therefore deal in succession with (I) Distortions in foreign trade, (II) Distortions in factor markets, namely for labour and capital, (III) Problems caused by a non-optimal income distribution, which includes a discussion of the problem of 'employment,' (IV) The problems, if any, posed by inflows and outflows of foreign capital associated with particular investment projects, which includes the 'debt servicing' problem, (V) The general problems of project evaluation in a second-best world, particularly one in which there are distortions caused by non-optimal taxes and subsidies.

In the first four sections of the paper we will adopt a piecemeal approach to the various distortions and problems, assuming that, apart from the specific distortion being considered, the economy corresponds in all other respects to the perfectly competitive paradigm. The last section will consider the problems posed as a result of the simultaneous existence of a number of distortions.

The term 'distortion' is used in its technical and convenient shorthand sense of any phenomenon which causes the equivalence of $EY=ICV=market\ price$ to break down. It should not be taken to have any necessarily normative significance in itself.
I. FOREIGN TRADE DISTORTIONS

17. One of the most important sources of divergence between the \( IC \)'s and \( ISV \)'s of commodities in LDC's is the restriction of foreign trade by trade taxes and subsidies and/or quota restrictions. Trade distortions introduce two sets of divergences in the domestic price system:

(a) between the relative prices within the traded goods sector and

(b) between the relative price of traded to non-traded goods. To see this it is convenient to proceed in two steps. First by considering a simple numerical example in a model with only two traded goods, and then, extending this by including a non-traded good. Following this theoretical discussion, we consider how the alternative procedures deal with the two above sets of distortions, in practice.

A. Traded Goods

13. Consider a perfectly competitive, open economy which produces two traded goods (say cloth and food) with two factors of production (capital and labour). Under free trade and given constant terms of trade, the domestic import/export prices of the two goods and rental/wage rates of the two factors will be the relevant 'shadow' prices.2/

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1/ A fuller and more rigorous treatment of the issues treated in this section will be found in Lal /177/.

2/ We assume away various capital-theoretic puzzles in defining 'capital'. See /217/ for a discussion of these puzzles in relation to project analysis.

3/ In technical terms, in this model, the optimal pattern of production and trade will be uniquely determined by the tangency of the terms of trade line with the domestic production possibility frontier. The consumption point being determined by the tangency of the same terms trade of line with the highest attainable social indifference curve for the two commodities. As a result feasible welfare (given resource, technological and foreign trade constraints) will be maximised when the following marginal equivalence prevails:

\[ fr = dr = mrs \]

(continued on next page)
19. Taking cloth as the importable, and food as the exportable, in this simple economy foreign exchange can be saved by producing more cloth and/or earned by producing more food.

20. Suppose, however, that instead of following the policy of free trade, the government imposes a tariff on cloth as it is a convenient way for raising tax revenue.\(^1\) We are then asked to evaluate the relative desirability of expanding domestic production of the importable (cloth) and the exportable (food). To get the correct relative social ranking of these two industries it will

\[ \text{cont.} \]

where \( \text{frt} \) is the marginal foreign rate of transformation, \( \text{drt} \) is the marginal domestic rate of transformation, and \( \text{mrs} \) is the marginal rate of indifferent substitution in consumption of the two commodities. The relevant 'shadow' prices of the two commodities are given by the international (frontier/border) prices of the two commodities. Furthermore from Samuelson's theorem on the correspondence of factor and commodity prices it follows that relative factor prices (of capital and labour) will be uniquely determined by the given international prices of the two commodities. If now even a single money price of a domestic good or factor is given, all other money prices, and the foreign exchange rate which converts foreign money prices into domestic money prices would be uniquely determined. Alternatively, if the foreign exchange rate were given, the domestic money prices would be uniquely determined. Moreover a change in the foreign exchange rate would have no real effects on the economy, as it would only affect the absolute level of domestic money prices, without affecting the relative price structure which would remain the same as that given by the unchanged international prices. The argument can be generalised to include traded intermediate goods and naturally carries over to the case of \( 'n' \) commodities which are all traded. Furthermore the model can be made dynamic given the intertemporal vector of international prices of the commodities, which will uniquely determine the intertemporal configuration of production and trade; the associated 'shadow' prices of the dated commodities and factors being determined by the terms of trade i.e. each period.

\[ 1/ \text{As a result we will now have a divergence in the marginal equivalences for optimality. Now } \text{frt} \neq \text{drt} = \text{mrs}. \]
be necessary to correct for the divergence in the relative domestic prices of the two traded goods, introduced by the tariff. The 'shadow' relative price of the two goods is given by the relative foreign prices. The correction for the divergence can be done by either (1) taking the foreign currency prices of the two goods and multiplying them both by a shadow exchange rate (SER) (which on certain assumptions will be equal to the tariff on the importable), to get the 'shadow' prices of the two goods in domestic currency which is the numeraire. This is the UNIDO /32/ Harberger /17/ Schydowsky /27/ (UHS) procedure; or (2) using foreign currency as the numeraire in which case the foreign currency prices of the two goods will be their 'shadow' prices. This is the Little-Hirlees /24/ procedure.

21. To see this consider the following numerical example.

22. **Numerical Example 1:**

23. Assume that the foreign price (cif) of cloth is $200, and of food (fob) is $100. The official foreign exchange rate is $1 = Rs 1. Also suppose that we observe the following costs of production of cloth and food:

- 1 unit of cloth requires 10 units of labour and 20 units of capital.
- 1 unit of food requires 15 units of labour and 2.5 units of capital.

The wage rate and rental rate, the same in both industries (as we are assuming no distortions in domestic factor markerc), are Rs 5 and Rs 10 respectively. The tariff on imports of cloth is 25%. The domestic price of food is Rs 100. Thus,

- Cloth -- cif price - $200; tariff - 25%, domestic price - Rs 250
- Food -- fob price - $100; domestic price - Rs 100.

Wage Rate -- Rs 5; Rental Rate -- Rs 10.
At the existing domestic market prices the domestic money costs of the two commodities will, in this case, be equal to the domestic money prices of the two commodities. There is no reason for preferring investment in the production of a little more of one of the two commodities rather than the other, as shown in the table below.

24. Table I
Costs of Production and Prices

<table>
<thead>
<tr>
<th>Good</th>
<th>Labour (units)</th>
<th>Wage (Rs)</th>
<th>Capital (units)</th>
<th>Rental (Rs)</th>
<th>Foreign Price ($</th>
<th>Exchange Rate</th>
<th>Tariff ($</th>
<th>Domestic Price (Rs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cloth</td>
<td>10</td>
<td>5</td>
<td>20</td>
<td>10</td>
<td>200</td>
<td>$1=Rs.1</td>
<td>25</td>
<td>250</td>
</tr>
<tr>
<td>Food</td>
<td>15</td>
<td>5</td>
<td>2.5</td>
<td>10</td>
<td>100</td>
<td>$1=Rs.1</td>
<td>--</td>
<td>200</td>
</tr>
<tr>
<td>Laundry</td>
<td>6</td>
<td>5</td>
<td>2</td>
<td>10</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>50</td>
</tr>
</tbody>
</table>

25. However, the tariff has as it were introduced a wedge between the MSC of producing and the MSV of using a unit of foreign exchange. The MSC of 'producing' foreign exchange will depend upon whether it is 'produced' by an expansion of exports of food or by expanding import substitute production and hence a reduction in imports of cloth. If the increase in foreign exchange is the result of a combination of both export expansion and import reduction, the MSC of 'producing' foreign exchange will be a suitably weighted average of the domestic resource costs of producing importables and exportables.

26. The MSV of foreign exchange is given by the value of a unit of foreign exchange to consumers. It as foreign exchange can be 'produced' by expanding exports and/or reducing imports, it can be 'consumed' by increasing imports of cloth and/or reducing exports and consuming more of the exportable food.

1/Note that a third industry laundry is shown in this Table. This should be disregarded for the moment, but it will be introduced in the second numerical example, p. 21 and following.
27. (a) We first show how on the various procedures, identical results will be obtained if a \textit{single} conversion factor for converting foreign currency into domestic currency values is used. For simplicity, we assume that foreign exchange is 'produced' solely by expanding exports of food, and 'consumed' entirely by expanding imports of cloth. Then the MSC of foreign exchange is given by the domestic resource cost of a unit of food exports, i.e. \((15 \times 5) \text{ the labour cost } + (2.5 \times 10) \text{ capital cost } = \text{Rs.} 100\) .

28. The MSV of foreign exchange is given by the domestic price (value) of the units of imports of cloth, made possible by exporting one unit of food. As the foreign price of food is \$100, and of cloth \(\text{Rs} 100\), one unit of food exported will enable 0.5 units of cloth imports. As the domestic price of cloth is \(\text{Rs} 250\), the domestic value of the imports of cloth made possible by one unit of exports of food is \(\text{Rs} 125\). Hence the MSV of the foreign exchange generated by exporting a unit of exports is \(\text{Rs} 125\), whilst the MSC of earning the foreign exchange generated by a unit of exports is only \(\text{Rs} 100\). Clearly the MSV of using foreign exchange is greater than the MSC of producing it. Evaluation of the social profitability of the exportable food at market prices will thus understate its true social profitability, as the domestic price of the exportable \(\text{Rs} 100\) (which is also its MSC) is less than the MSV of the foreign exchange one unit of exports make possible, namely \(\text{Rs} 125\). The correct shadow price of the output of food is therefore \(\text{Rs} 125\) and not the market price of \(\text{Rs} 100\). The shadow prices of the inputs will be the market prices. Hence we have the following social cost-benefit relationships of an investment project to produce one more unit of one or the other of the two commodities.

\begin{tabular}{l l l}
\textbf{Food:} & \textbf{Costs:} & \((15 \times 5) \text{ the labour cost } + (2.5 \times 10) \text{ capital costs } = \text{Rs.} 100\) .

\textbf{Benefits:} & \(1 \times 125 = \text{Rs} 125\).

\textbf{Net Social Benefit:} & \(125 - 100 = \text{Rs} 25\).  
\end{tabular}
Cloth: Costs: (10x10) labour costs + (20x10) capital costs = Rs 250.

Benefits: 1 x 250 = Rs 250.

Net Social Benefit: 250 - 250 = Rs 0.

Thus investment in food is socially profitable, even though at market prices the private profitability in the food industry is also Rs. 0. As a result at 'shadow' prices production of food will be expanded. Thus we see that in this example with a tariff on the importable, cloth, the only correction we need to make to market prices is to the market price of a unit of the exportable to get its shadow price. This correction is to multiply the domestic price of food by 125/100 = (1+.25). But remembering that the tariff on cloth is 25%, this shows that the domestic price of the other traded good, food, must also be multiplied by this tariff. 1.25 can then be taken to be the shadow exchange rate (SER) by which the foreign currency prices of both importables and exportables must be multiplied to get the correct social investment decisions. The net result will be to make the relative shadow prices equal the relative foreign prices of the two goods.

Alternatively, if we used foreign currency as our numeraire, and converted the domestic money values of the factors of production into foreign currency equivalents at the SER of 1.25, then we could equivalently have determined the relative social profitability of the two goods as follows:

Food: Costs: (15 x 5/1.25) labour costs + (2.5 x 10/1.25) capital costs = $80

Benefits: $100

Net Social Benefit: $100 - $80 = $20

Cloth: Costs: (10 x 5/1.25) labour costs + (20 x 10/1.25) capital costs = $200

Benefits: $200

Net Social Benefits: $200 - $200 = 0
(Note that the domestic factor prices have been converted into foreign exchange at the SER of $1 = Rs 1.25). Clearly, again food production is socially more desirable, at the margin, than cloth production.

30. The latter procedure of working out the costs and benefits of the project in terms of foreign exchange would be the Little-Mirrlees (LM) procedure, if we had used a single conversion factor equal to the SER to convert domestic money costs of the factors of production into foreign currency.

31. However, as is emphasized in the next section, LM do not generally use a single SER as a conversion factor for converting domestic money values into foreign currency, and this leads to certain differences in practice when compared with the UHS procedures. The former procedure using the SER of 1.25 to value the two traded good outputs is the SER procedure recommended by Harberger, Schydowsky and UNIDO (the UHS SER). The two are equivalent in this case and merely involve a change in numeraire.

32. The third method, the Bruno-Krugor (BK) method, is also equivalent. By this method the domestic resource cost per unit of foreign exchange saved/earned by the projects would be computed and the resulting ratios compared with the shadow exchange rate. This would yield for

\[
\text{Food: } \frac{Rs (15 \times 5) + (2.5 \times 10)}{\$100} = 1 < 1.25 \quad \text{(the shadow exchange rate assumed is } $1 = Rs 1.25) \\
\text{Cloth: } \frac{Rs (10 \times 5) + (20 \times 10)}{\$200} = 1.25
\]

and clearly again an increase in food production should be favoured as compared with an increase in cloth production.

33. (b) Next, we relax our simplifying assumption that foreign exchange is 'produced' solely by increasing exports of food, and 'consumed' only by increasing imports of cloth. We first consider the case with domestic currency as the numeraire.
The MSC of producing foreign exchange by expanding food or cloth production are still given in this more general case by the domestic costs of producing the two goods. What of the MSV of 'consuming' foreign exchange. A unit expansion of the cloth (food) industry results in foreign exchange earned of $200 ($100). Now suppose that a unit increase in foreign exchange is 'consumed' by increasing imports of cloth of $\mathcal{L}$, and decreasing exports of food of $\mathcal{F}$, in foreign exchange (with $\mathcal{L} + \mathcal{F} = 1$). The MSV of a unit of foreign exchange will then be the domestic value of $\mathcal{L}$ of imports of cloth plus $\mathcal{F}$ of exports of food. This is given by: $\mathcal{L} = \int (\mathcal{L}/200)x200x1.25 + (\mathcal{F}/100)x100x1.25 = \int (\mathcal{L}x1.25) + \mathcal{F}$. Let us denote this by $E$, and it will be the SER in this more general case. We can now determine the relative social profitability of the two goods, which will be:

**Food:**
- Costs: Rs 100 (as before)
- Benefits: $100 \times E = Rs 100E$
- Net Social Benefits: Rs 100E - Rs 100 = positive

**Cloth:**
- Costs: Rs 250 (as before)
- Benefits: $200 \times E = Rs 200E$
- Net Social Benefits: Rs 200E - Rs 250 = negative

as the value of $E$ must lie between $\mathcal{L} = Rs$ (when $\mathcal{L} = 0$) and $\mathcal{L} = Rs 1.25$ (when $\mathcal{F} = 0$). Hence as before food production will be socially more profitable than cloth.

Alternatively, we could have taken foreign currency as the numeraire. The social profitability of food and cloth production would be determined as follows. The MSV of the two goods would still be given by their foreign exchange prices. What of the MSC's? These will consist of the foreign exchange equivalent values of the primary factors used in the production of the two goods. We could convert the domestic money values of these
primary factors into foreign exchange values at the general SEI of E, and we would then obtain an identical result as in the case with domestic currency as the numeraire.\(^1\) However, in general, the use of a single conversion factor for converting the factor prices into foreign exchange equivalents will not be correct, for the factor prices to be used in our social profitability calculations should be the opportunity costs of these factors in terms of foreign exchange in an alternative use. This opportunity cost will be equal to the foreign exchange value marginal product (VMP) of the factors in the industries from which they are drawn for use in the industry whose output is being expanded. Thus the foreign exchange VMP of labour (capital) in an alternative use when the food industry is being expanded is the foreign exchange VMP of labour (capital) in cloth production (given our implicit full employment assumption); and conversely for expansion of the cloth industry. Thus the shadow price of labour for the food industry is \$5/1.25 = \$4, and for the cloth industry is \$5/1 = \$5; whilst that for capital is \$10/1.25 = \$8 for the food industry, and \$10/1 = \$10 for the cloth industry; where the conversion of domestic VMP into foreign exchange VMP of factors from the food (cloth) industry is done at the effective exchange rate which applies to food (cloth) output, namely \$1 = As 1 (1 = As 1.25).\(^2\) The relative social profitability of the two goods is then:

\[ \frac{VMP_{food}}{VMP_{cloth}} = \frac{4}{8} = \frac{1}{2} \]

\(^1\)This was the assumption we made in Case (a) above, but as we emphasized this is not the general practice recommended by LM.

\(^2\)Thus the correct relative social profitability on IA lines of the two industries in example 1(a) would also be given by the calculations which follow.
Food: Costs: (15x4) labour + (2.5x8) = $80
Benefits: $100 (as before)
Net Social Benefit: $20

Cloth: Costs: (10x5) labour + (20x10) capital = $250
Benefits: $200 (as before)
Net Social Benefits: $50

and once again food is more profitable than cloth. This is the general LM method, and it will rank the projects in the same order as the SER method. However, note that whereas the SER method averages across the implicit effective exchange rates on food and cloth (by applying the weights $ \alpha $ and $ \beta $), the LM method actually uses the multiple effective exchange rates as conversion factors. As such it is likely to be more accurate, as well as easier to apply, as it is not easy to decide what weights $ \alpha $ and $ \beta $ should be used in determining the average SER on the alternative methods.

36. Finally, the third method BK will once again be a straightforward transformation of the SER test. In the inequalities we have derived above for this method, in this more general case we will now have to substitute $ E $ for 1.25 as the SER on the right-hand side.

37. Thus on all three procedures in this simple model with only traded goods, the major adjustment which is required to get the right social investment decisions is to correct for the divergence between the relative prices of the two traded goods, caused by the protective structure, and all three procedures will give identical social rankings of the two industries.
B. Non-Traded Goods

The above case is however extremely simplified, as it did not include non-traded goods. The introduction of these goods introduces another distortion resulting from the protective structure. In addition to the distortion of the relative prices within the traded goods sector (which was the only distortion in the previous case) there will now be a further distortion in the relative prices of traded to non-traded goods resulting from protection. The adjustments which are necessary to obtain the correct social investment decisions will moreover depend upon whether the existing protective structure is assumed to (a) remain unchanged, or (b) to be removed, in the future. If it is assumed to remain unchanged, then the only adjustments required are those for the distortion in relative prices of traded goods, discussed in the previous section. If however, the economy is assumed to move to free trade, then it will be necessary to estimate (i) the relative fall in the price of the traded and non-traded goods, which can occur via an exchange rate change (assuming a fixed domestic money price of the non-traded good) or a fall in the price of the non-traded good (assuming a fixed exchange rate)\(^1\) (ii) the change in the wage-rental ratio which will accompany the change in the relative price of traded to non-traded goods. Given estimates of these changes, the two basic alternative procedures—(1) the SER method which uses domestic currency as the numeraire, and (2) the LM method which uses foreign currency as the numeraire—will give identical social rankings of the two industries. The SER to be used as procedure (1) will, however, not be the MSV of

\(^1\) or a combination of the two.
foreign exchange in the protection situation as in the previous section (th. UHS SER), but will be the 'equilibrium' free trade exchange rate. (This can be called the Baci:sa-Taylor (BT) SER, after the joint authors who have recommended its use \( \text{SER} \)).

39. To see this consider the following numerical example.

40. **Numerical Example 2:**

41. We expand our previous numerical example by including a third, non-traded, good called Laundry, whose domestic price is Rs. 50 per unit. The costs of production of Laundry in the protection situation are:

42. 1 unit of laundry requires 6 units of labour and 2 units of capital and as the wage rate is still assumed to be Rs. 5, \( \text{labour} \) and the \( \text{capital} \) rate of capital, Rs. 10, the domestic money costs of production of laundry are Rs. 50, which is also its domestic money price. Hence as in the case of food and cloth (the two traded goods) there will be no reason for preferring investment in the production of a little more of one of the three commodities rather than the other two. However for the reasons noted in the case with only two traded commodities, valuation at domestic market prices understates the relative social benefit from producing food rather than cloth, and adjustments on the lines of any of the three evaluation procedures will correct for this in an equivalent manner. But what of comparisons of investments in laundry production with either food or clothing? This will depend crucially upon whether or not the existing protection structure will be maintained.

43. (a) First assume that the existing protection structure is expected to remain unchanged. As 'ex hypothesi', a marginal investment project will not change the wage, rental rates, the MSC's of production of the three commodities. taking domestic currency as the numeraire are still given by
their market costs of production. It is still however necessary to make
corrections to the values of the three goods, to obtain their MSV's. In
domestic currency the MSV of cloth is Rs \((200 \times E) = Rs 200E\), the MSV of
food is Rs \((100 \times E) = Rs 100E\) (for the same reasons as in the pure traded
goods case), and that of laundry is Rs 50. (The market prices are Rs 250,
Rs 100 and Rs 50, respectively -- see Table I, p. 13). Hence in this case,
like the case with only traded goods, the only adjustment is the correction
for the distortion between the MSC and MSV of producing and using a unit of
foreign exchange, which is done by using a SER of E (whose value lies
between 1.25 and 1) to convert the foreign prices of both food and cloth
into their MSV's in domestic currency. This is the practice recommended
by UHS.

44. Alternatively we could have used foreign currency as the numeraire
following the EM method. The MSV's of the two tradeable goods food and cloth
would still be their foreign exchange 'border' prices, and if the factors
employed in their expansion are drawn from the other tradeable good industry,
the foreign exchange VMP of the factors in the traded good industry from
which they are drawn would be the 'shadow' factor prices, and the MSC of
production of the two traded goods would be determined as in the first
numerical example, Case (b). What if the factors are drawn from the non-
traded good industry, laundry; and what will be the shadow price of the
output of laundry?

45. The answer to the last part of the question is that if (as IM
assume) the demand and supply for non-traded goods is always kept in balance
(and as we should make explicit, non-traded goods are produced under constant
cost conditions) the MSV of the non-traded good will equal its MSC. The
latter can be determined directly from the cost conditions of laundry.
production, with the primary factors being valued at the foreign exchange VMP in the traded good industry (food and/or cloth) from which they are drawn. Note that as the MSV=MSC for laundry, the net social benefits of laundry production will be zero.\[1\]

This leaves the question of determining the shadow prices of primary factors drawn from the production of laundry (the non-traded good) to expand the output of cloth (food). The first round effect of this will be to reduce the output of laundry (as we are assuming full employment of the factors), which will tend to raise its domestic money price (as by definition all domestic demand for non-traded goods is met from domestic production), and hence raise the domestic money wage and rental rates in the laundry industry (as these are equal to the now higher VMP in domestic currency of the two factors in laundry production). This in turn will induce factors from the third industry food (cloth) to flow into laundry production (as the VMP's and hence factor prices in domestic currency in food (cloth) are unchanged given the fixed border price of food (cloth)). This will reduce the wage-rental rates in laundry production, and hence the price of laundry in the second round back to their original values (assuming that all changes are marginal displacements around an equilibrium position). The net effect of expanding cloth (food) production will have been to indirectly reduce the output of food (cloth), with the factors required for expanding cloth (food) output coming indirectly from the food (cloth).

\[1\] Thus if laundry expansion draws upon primary factors from say the food industry, the MSC of a unit of laundry production and the value of a unit of its output, in foreign exchange, will be: \((5 \times \$5)\) labour + \((2 \times \$8)\) capital = \$40. As the social costs and benefits are both \$40, the net social benefit is 0. Alternatively, if laundry expansion draws primary factors from the cloth industry, the social costs and benefits are \((6 \times \$5)\), labour + \((2 \times \$10)\) capital = \$50, and once again, as ex hypothesi MSC=MSV of non-traded goods, the net social benefit is 0.
industry, even though the first round effect is on the non-traded good industry, laundry.1

Hence, the shadow prices of the factors in cloth (food) industry will still be their foreign exchange VMP's in the food (cloth) industry, that is, $4($5) for labour, and $8($10) for capital. The rankings of the three industries is then given by their relative net social benefits which are

Food - $20
Laundry - 0 (from above)
Cloth - $50 (from numerical example 1(b)).

Thus both the LM and SER methods (as well as the BK ratio which will just be a straightforward transformation of the SER test) will give the identical ranking of industries. However, as before, unlike the SER method, which averages across the effective multiple exchange rates on the traded commodities, the LM method in deriving its shadow prices will use

1/It should however be noted that in general, when resources are withdrawn from the non-traded good industry (laundry), output and hence consumption of laundry could fall, and hence the implicit assumption made above, that the final effect is entirely on the output of traded goods, would be invalid. The foreign exchange equivalent value of any such consumption foregone, would be obtained by using a consumption conversion factor which is normally derived on the LM method in the estimation of their shadow wage rate. This converts the value of Rs 100 of domestic consumption in domestic currency into say $y of foreign currency equivalent. This is done by revaluing the goods (and services) which enter into consumption at domestic prices (obtained from consumer expenditure surveys) into their 'border' price equivalents. This consumption conversion factor is the closest analogue to the estimation of an SER or the LM method. But note that if it is possible to identify the groups whose consumption is effected and their pattern of expenditure is known, then on LM lines there will be a multiplicity of consumption conversion factors estimated. For estimates of a conversion factor for the consumption of agricultural households in Maharashtra see Lal [217]. Once such a conversion factor has been derived, the conversion of say Rs n of consumption foregone of laundry, in domestic currency, can be converted into the foreign exchange equivalent value, by using the conversion factor of $y = Rs 100 to obtain the MSV of the foregone consumption in foreign exchange as $y.n/100.
explicit multiple conversion factors which correspond to the extant multiple exchange rates.

49. (b) Secondly, assume that the protective structure will be removed in the future. Clearly the relevant shadow prices for evaluating the desirability of investment in food, clothing and laundry will now be the MSC's and MSV's of the goods and factors in the free trade situation. With the removal of the tariff of 25% on imports of cloth, the relative domestic prices of the three goods (at the protection exchange rate of $1 = Rs 1) will change. With a reduction in the price of cloth relative to both the prices of food and laundry, there will be a shift in domestic consumption from food and laundry towards cloth (assuming unrealistically that cloth, laundry and food are gross substitutes), and of domestic productive resources from production of cloth to production of food and laundry. Now consider the markets for food, cloth, and laundry. In the market for cloth there will be excess demand, whilst in the markets for food and laundry there will be excess supply. Moreover unless the excess demand for cloth is matched by an equivalent excess supply of food (an exceptional circumstance), there will tend to be a balance of payments deficit, given by the differences between the excess demand for cloth and the excess supply of food. What is more, from Walras' Law, this net excess demand for the two traded goods must be exactly equal to the excess supply of the non-traded good, laundry. In the next stage therefore to restore equilibrium, it will be necessary to cure the balance of payments deficit, that is to eliminate the net excess demand for tradeables which is equivalent to eliminating the excess supply for the non-traded good. This requires a fall in the relative price of the non-traded to the traded goods.
50. The above change can be brought about by two alternative mechanisms (or a combination of both). The first is with the exchange rate fixed, and the domestic money price of the non-traded good, laundry, flexible. The second, is with the domestic money price of the non-traded good fixed and a flexible exchange rate. As the same relative price of traded to non-traded goods needs to be established (on either adjustment mechanism) to restore equilibrium, the necessary fall in the price of the non-traded good (with a fixed exchange rate) must be equal to the required devaluation of the exchange rate (with the price of the non-traded good fixed). As a result the domestic money prices of the three goods will be the same in free trade on both adjustment mechanisms. Hence they will lead to identical resource allocation effects and factor price changes from the protection situation.

51. Assuming that we know or can guess the changes in the wage and rental rates and the exchange rate or the price of the non-traded good from the protection to the free trade situation, then either of the two alternative methods of using domestic currency as the numeraire and a SER, or foreign currency as the numeraire and the LM procedures, will give identical rankings of the relative social profitability of investment in the three industries. Note however that the relevant SER will not be the SER which was derived for the case when existing protection is assumed to continue, but will be the 'equilibrium' free trade exchange rate (the BT SER).

C. Alternative Procedures

52. We are now in a position to compare the alternative procedures which have been suggested to take account of trade distortions in developing countries. First, there are the SER methods. There are two subdivisions within these depending upon the particular assumptions made about future trade liberalization.
53. (1) The UNIDO G327, Harberger [17], Schydowsky [217] (UHS) SER method. This obtains the SER as the MSV of foreign exchange in the protection situation, as the "weighted sum of domestic prices of traded goods, divided by a similar weighted sum of world prices, the weights in each case being the marginal changes in imports and exports induced by the project." \(^1\) The UHS SER is then used to shadow price all the traded inputs and outputs by converting their foreign currency values into domestic money shadow prices at the SER. In the absence of all other distortions, apart from trade distortions, the shadow prices of the remaining non-traded goods and the factor prices would be the market prices in the protection situation. This method is clearly valid, on the assumption that the existing protection structure will remain unchanged.

54. (2) The 'equilibrium' SER method, most recently advocated by Bacha and Taylor (BT) [17]. This method works out the 'equilibrium SER', which

\[ \text{UHS SER} = \sum_{i=1}^{n} \frac{f_i}{p_i \text{ cif}} + \sum_{i=n+1}^{n+h} x_i \frac{p_i \text{ D}}{p_i \text{ fob}} \]

where \( f_i \) - is "the fraction of foreign exchange allocated to imports of the \( i \)th of \( n \) commodities at the margin."

\( x_i \) - is "the rupee amount by which each of \( h \) exports falls in response to earnings of foreign exchange."

\( p_i \text{ D} \) - are the domestic market clearing prices of imports & exports, that is inclusive of trade taxes (and subsidies)

\( p_i \text{ cif} \) and \( p_i \text{ fob} \) - are the 'border' prices of imports and exports.

Maurice Scott in his written comments has pointed out that this formula "assumes that relative domestic prices of traded goods correctly measure their relative marginal contributions to aggregate consumption. This could be right, but it certainly is not, especially if the traded goods in question are intermediate products subject to varying tariffs and/or quotas. It therefore seems to me that the formula is conceptually wrong as well as being operationally difficult to apply." The correct SER for UNIDO he feels "is the ratio of the domestic to the foreign exchange cost of a marginal increase in aggregate consumption. In IM terms this would be the conversion factor for marginal consumption expenditures."
would exist after trade liberalization, in free trade.\footnote{The formula for calculating the BT SER is: (see \cite{17}).}

The foreign currency values of traded goods are converted into shadow prices by multiplying them with this BT SER. The prices of non-traded goods are taken as the market prices in the protection situation. This procedure is clearly valid if it is assumed that trade liberalization will take place with exchange rate flexibility and the prices of non-traded goods inflexible.

However for the procedure to result in correct investment decisions, in addition to shadow pricing traded goods by using the BT SER, it is also necessary to determine the factor prices in free trade, and use these to value the primary inputs used in the project.

Secondly, there is the Bruno-Krueller (BK) ratio \cite{22,167}. As can be seen from the first numerical example given above, the BK ratio is derived by a mere rearrangement of the terms used in deriving the rates of return on the SER methods. Given the same assumptions about trade

\footnote{\[ \text{BT SER} = r \left[ \sum_j \phi_j \left( \frac{V_j^m}{V_j^e} \right) \frac{\gamma_i}{\gamma_i} \left( - \frac{N_i^m}{N_i^m} \right) \right] \]}

\[ \text{where:} \quad r \quad \text{is the protection exchange rate} \]
\[ \phi_j \quad \text{is the 'force of the export, tax or subsidy' on jth export.} \]
\[ \gamma_i \quad \text{is the 'force of the tariff' on ith good.} \]
\[ V_j^e (M_i) \quad \text{are the shares of exports(imports) of sector j(i)} \]
\[ \text{in total exports (imports).} \]
\[ E_j^x \quad \text{is the price elasticity of export supply of the jth good.} \]
\[ N_i^m \quad \text{is the price elasticity of import demand of the ith good.} \]

\[ \alpha = \sum_j V_j^e E_j^x - \sum_i M_i^m \]
liberalization, it will give the same ranking of industries as the UHS SER (if there is no trade liberalization) and the BT SER (if there is trade liberalization). The cut-off exchange rates with which the BK ratio is compared being the UHS SER in the first case and the BT SER in the second. Primary factors being priced at market prices in the protection situation in the first case, and at the free trade factor prices in the second. As the method requires the same information as the SER methods, and is really just a variation of these methods, it can be subsumed under them. However, the resulting ratio does not have obvious intuitive links to capital and growth theory in contrast with rate of return measures, and this could be a disadvantage. Also, in the past most investment appraisal has been done in terms of rate of return measures, and a substitute measure would only be justifiable if it were a better measure. The BK ratio being a straightforward transformation of the relevant SER measure cannot be a better measure of social profitability than the rate of return measures. We will therefore not consider it a serious contender for adoption as a general project selection procedure.

56. Thirdly, there is the Little-Mirrlees procedure. This method takes foreign currency as its numeraire, values tradeable inputs and outputs\(^1\)/ at their border prices (cif price if an importable, fob if an exportable)\(^2\)/ and those of non-tradeables as the MSC of production determined by breaking down the costs of production into tradeables and primary factors. The

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\(^1\)/It is assumed in this section that trade distortions are in the form of tariffs; import quota restrictions are considered in Section I.E.

\(^2\)/If the country is a monopolist/monopsonist, in foreign trade for any good, then the relevant border prices are the marginal revenue/cost in exporting/importing the good.
former then being valued at border prices and the latter by evaluating the marginal product of these factors in terms of foreign exchange. It can be used on both the alternative assumptions that existing trade restrictions are going to continue, as well as on the alternative assumption that there will be future trade-liberalization. As we have seen in terms of the simple models outlined above,

57. (1) If the protection structure is assumed to remain unchanged, the LM method gives equivalent social rankings of investment projects as the UHS SER method. The same adjustments are required in the relative prices of traded goods, which on both the LM and UHS procedures will be equal to their 'border' relative prices. For non-traded goods and primary factors the LM method would estimate specific conversion factors. For primary factors these would be the ratio of the VMP in domestic to that in foreign currency, whilst for non-traded goods it would be given by revaluing the MSC of production in foreign exchange to obtain the 'shadow' price of the non-traded good in foreign exchange, and the ratio of the market to 'shadow' price would then be the conversion factor for the non-traded good. On the UHS method in contrast, an average conversion factor (the SER) would be worked out to convert foreign currency values of traded goods into 'domestic currency' values.

58. (2) If trade liberalization is assumed, with the price of non-traded goods fixed, but a flexible exchange rate, the LM method would give equivalent social rankings of investment projects as the BT method. The LM method would take the foreign prices of tradeables as their shadow prices, and work out the implicit prices of the non-traded goods and factors in the free trade situation in terms of foreign exchange equivalents,
implicitly at the free trade 'equilibrium' exchange rate, which is the BT SER. The correct application of the BT SER method would involve obtaining the shadow prices of the traded goods by multiplying their foreign currency values by the BT SER. The shadow prices of the non-traded goods would be their market prices in the protection situation (as ex hypothesi the prices of non-traded goods are inflexible), and the factor prices would be the domestic money prices of the factors which would exist under free trade. The latter are clearly needed by both the LM and BT SER methods.

59. Thus, there are essentially two basic methods of project appraisal, the domestic currency as numeraire, SER methods, and the foreign currency as numeraire, LM methods. In principle as we have shown the two types of methods involve nothing more than a change in numeraire. In practice, however, there are certain advantages in using the LM (foreign currency as numeraire) methods rather than the SER (domestic currency as numeraire) methods in a relatively open economy. The next section discusses these issues.

D. LM and SER Procedures in Practice

60. The relative advantage in a relatively open economy of using the LM procedures rather than the SER ones, in practice, depends essentially upon its estimation and use of multiple conversion factors for converting non-traded goods and primary factors (domestic currency items) into foreign currency (the LM numeraire), in contrast with the SER procedures which use a single conversion factor, an SER, for converting foreign currency into domestic currency (the SER method's numeraire).

1/ This section has been considerably improved by the written comments of Maurice Scott on an earlier draft.
Note that (as we have emphasized) in principle both methods require the same information, and merely involve a change in numeraire. Thus to compare the two methods, it is simplest to abstract from this change by working for the moment in the same numeraire, say foreign currency, to see the differing prescriptions in practice on the two procedures. As we saw in Numerical examples 1 and 2, both methods would take the relative prices of traded goods to be their border prices, and as we are taking foreign currency as the numeraire, these would be the border prices in foreign currency. This leaves the problem of converting various 'domestic currency' items (non-traded goods, primary factors and domestically produced tradeables) into foreign currency equivalents. If as in numerical example 1(a) we use a single conversion factor (the inverse of an $\text{SER}$) to make the conversions, then the two methods $LM$ and $\text{SER}$ are also identical in practice. However, as was emphasised in numerical example 1(b), this process involves averaging across a multiplicity of actual (implicit) effective rates of exchange. The derivation of an average single conversion factor on $\text{SER}$ lines, as opposed to the estimation and use of the actual multiple conversion factors on $LM$ lines then creates two types of problems in practice for the $\text{SER}$ method.

The first is of accuracy, and the second the ease with which the exercise can be done. Any process of averaging must to some extent be arbitrary. As we saw in numerical example 1(b), the estimate of the $\text{UHS SER}$ depended crucially upon the weights $\alpha$ and $\beta$. There is some doubt whether conceptually the weights which are recommended are the right ones to use in an economy which uses imported intermediate goods subject to
differentiated tariffs and/or quotas. Whilst even if this were clear, it is not easy in practice to determine these weights. Finally, often the goods over which the averaging is to be done is also not clear. Thus in many cases in deriving an SER, all locally produced items, even if they are tradeable, are counted as domestic currency items, and even though their relative domestic prices are very different from their relative border prices. An SER derived by treating these goods as non-traded (and implicitly with their relative domestic prices assumed to measure their relative marginal contributions to aggregate consumption) could be a misleading parameter.

These difficulties in determining in practice the goods over which the averaging should be done and estimating the weights to be employed to obtain the single SER, show up in the widely divergent estimates of the SER which are made for the same country. The SER can thus be a very slippery concept and treacherous parameter. The main advantage of the LM procedures is that by using multiple conversion factors, they cut through this problem of deriving a single conversion factor (an SER). They will thus be both more accurate and easier to apply in practice.

63. It should be noted that there is one conversion factor determined on LM procedures which (at least conceptually) is closely analogous to an SER, namely the LM conversion factor for marginal consumption expenditures, which is normally estimated as part of the estimation process of determining the shadow wage rate. This conversion factor can also be estimated and

1/See fn. 1, p. 23.

2/Maurice Scott reports that he has seen estimates for Pakistan "which ranged from a premium of 25 to 100 or more per cent over the official rate." Whilst for India recent estimates of the UHS SER range from Beyer's estimates of US $1 = Rs 9.8 to 10.3, to Dasgupta's estimates of Rs 16.50 to Rs 21.00 (the official exchange rate is Rs 7.5 to US $1), implying premiums of 30 to 180 per cent over the official rate.
used to value any consumption foregone in cases where the basic assumptions of the LM procedures that the effects of the project are directly and/or indirectly on domestic production and trade are not justified.\(^1\) But it should be noted that in practice on the LM method there could be a multiplicity of these consumption conversion factors, depending upon the groups who are affected and their pattern of expenditure. If a conversion factor for aggregate consumption, namely the ratio of the domestic to the foreign exchange cost of a marginal change in aggregate consumption, is derived, this would be closely analogous to the SER determined on UHS lines. Whilst the use of such a consumption conversion factor (or factors) is clear-cut on the LM method, the use of this same (or similar) single conversion factor for converting all the domestic currency items into foreign currency ones (or vice versa) on the SER method, when there are a multiplicity of conversion factors for primary factors and non-traded goods in an economy with both tradeable and non-traded intermediate goods, and with a highly differentiated tariff structure, is by no means clear.

\(^6\) If, of course, on the domestic currency as numeraire methods, the LM practice of decomposing non-traded goods into their tradeable goods and primary factor components; of counting domestically produced tradeable goods as 'foreign currency' items; and of determining the consequent multiple conversion factors for non-traded goods and primary factors were also followed, then the two methods would be identical. There would be an LM consumption conversion factor (for aggregate consumption) to be used specifically for converting particular consumption changes, which would be

\(^1\)See fn. 1, page 23.
like an SER, but the general method would be the LM method. 1/

Finally, there are obvious diplomatic advantages in not having to calculate a specific factor labelled the SER, as governments are not likely to take kindly to the calculation (and publication) of a 'shadow' exchange rate for their countries.

E. Quantitative Restrictions (QR)

In the analysis of trade distortions, we have so far implicitly assumed that they were in the form of unchanging tariffs and subsidies. In practice however, most developing countries make extensive use of QR's along with tariffs. This considerably complicates the task of project evaluators. The correct shadow price of a good subject to a QR will depend upon how the QR regime is operated. (1) In one limiting case, the QR's could be operated in a manner equivalent to a tariff, whereby the full impact of any increased supply or demand for the good subject to a QR is on trade. Thus, if there was an increase in demand for the good, the QR would be relaxed, and conversely if there was increased domestic supply of the good. In this case, the same considerations we have discussed in the model exclusively with tariffs, would be relevant in determining the shadow price of the good. (2) The other limiting case would be where the QR is rigidly fixed, so that the impact of increased demand and supply of the good subject to a QR is purely on domestic consumption and production. In this case the good

1/ This has been explicitly stated by LM: "We have certainly seen project analyses where all non-traded purchases (in practice often called local purchases) are lumped together, and a single conversion factor applied. So we believe that the main superiority of the Manual is that it advocates the use of many exchange rates. If in fact UNIDO does the same, the differences between the two approaches could, we believe, be set dancing on the head of a pin." (75/7, p. 163.)
subject to a rigid import quota will be equivalent to a non-traded good
(the government having implicitly charged an infinite tax or transportation
charge on the importable after a certain level of imports). Once again,
in this case the methods of evaluation will be identical to the methods for
valuing non-traded goods on the alternative procedures discussed previously.
(3) The difficult problems arise in intermediate cases where the working
of the QR regime falls between these two limiting cases. Then the increased
use or production of the good subject to a QR may in part be on trade, in
part on domestic production and in part on domestic consumption. The
shadow price of the good will then be the appropriately weighted sum of
the producer’s and consumer’s surpluses associated with these changes in
trade, production and consumption. Clearly for goods which bulk large
in the costs and benefits of a particular project, and which are subject to
this intermediate type of QR system, it will be necessary to derive the
shadow price on the above principle for each individual case. However,
for a majority of goods subject to such controls, and which do not form
an important part of the cost-benefits of the project, it will be impractical
to make such detailed calculations for each and every input and output.
Shortcuts, as well as practical guidelines, then become essential. The
LM procedures suggest that for such partially traded goods, the general
assumption, except for important cases, should be that they are treated
as fully traded goods, if the quotas are worked closer to the flexible QR
type of regime, and as non-traded goods, if they are worked to correspond
to a rigid quota type of QR regime.
67. The UNIDO system, on the other hand, apart from stating the
theoretical principle, does not provide any general guidelines for such
goods. Nevertheless, the existence of such goods and of QR’s pose severe
problems for both the UNIOD and BT method, in the computations of their
respective SER's. For in general it is not possible to deduce the tariff equivalent of a quota from the ratio of domestic and foreign prices of the relevant good. And as it is these implicit and/or explicit tariff rates which appear in the BT and UHS SER's, it is extremely difficult to provide a general formula for the SER's under a quota regime, and even more importantly to obtain the necessary information for computing them accurately.

F. Summing Up

66. Thus summing up this discussion of the relevant merits of alternative procedures for taking account of trade distortion, clearly the first crucial judgment is with regard to the future trade control system. If it is assumed to remain unchanged, then the UHS SER or the equivalent LM procedure is appropriate. If trade liberalization is assumed to occur, then the BT SER and the relevant LM procedure (which is equivalent to it) will be appropriate. The difference lies in judgments about whether the relevant prices are the shadow prices corresponding to the MSC's and MSV's in the protection situation, or the 'equilibrium' prices corresponding to the free trade situation. There may be something to be said for doing calculations on both sets of assumptions.

69. Secondly, as regards comparisons of the relative merits of using LM or SER procedures, we have shown that in principle, they are equivalent, involving no more than a change in numeraire. They require the same information. In practice, however, LM methods could be more accurate and also easier to apply than SER ones in economies with a highly differentiated tariff structure and hence a multiplicity of effective exchange rates, for converting 'domestic' into 'foreign' currency values. Moreover, the
derivation of an average of these multiple conversion factors in the form
of a single SER is subject to all the difficulties (conceptual as well as
operational) involved in any process of averaging. Widely divergent
SER's may then be (and have been) calculated for the same country.\footnote{1/}
Hence there may be practical advantages in using the LM methods instead of SER
ones.

70. \textbf{Finally}, there are obvious diplomatic advantages in the LM
procedures in not having to estimate a parameter (a shadow exchange rate)
which is considered to be such a politically sensitive issue in many
developing countries.

\footnote{1/See footnote 2, page 33.}
II. DISTORTIONS IN FACTOR MARKETS

71. Distortions in both the markets for labour and capital have been discussed in the project evaluation literature. The two fully fledged evaluation procedures, the UNIDO and LM procedures, identify the same distortions and, except for some differences in assumptions about the likely future changes in some of the divergences, provide identical rules in principle, except for a change in numeraire. The UNIDO procedures take current consumption as their numeraire, the LM current savings.\[1\] Note that current savings generate the time stream of future consumption. As consumption, following the practice in theoretical welfare economics, is identified as the source of economic welfare, this means that the net benefits will be dated consumption, and there will be the problem of making commensurable present consumption and future consumption. As long as the same relative price between present and future consumption is used to 'add up' the intertemporal net benefits of the project, it does not matter which of the two relevant 'commodities' (present consumption or future consumption (savings), we take as our numeraire.

72. We turn first to examine the adjustments necessary to take account of the distortions in the market for capital.

A. Capital

73. Savings and investment are the means for changing the time shape of the intertemporal consumption stream which is feasible given resource and

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\[1\] More precisely the LM numeraire is 'uncommitted social income measured at border prices'. It need not be saved, but could be spent on uses (like administration, health, law and order, etc.) which are considered as useful as savings by the government.
technological transformation constraints. The capital market intermediates between those making savings and investment decisions. In a perfect capital market, the social return from one unit of current savings (the net present value of the consumption stream made possible by one unit of current savings) at the margin, is equal to the social value of one unit of current consumption. The former will depend upon the opportunities open to society in production, to convert one unit of present consumption into future consumption - that is the social productivity of investment - the latter on the weight society places on one unit of future consumption in terms of present consumption -- the social rate of time preference. In a perfect capital market, the rate of interest R will equal and equate the marginal rate of transformation (mrt) of present into future consumption, and the marginal rate of indifferent substitution (mrs) of present and future consumption. That is \( R = mrs = mrs \), of the two 'commodities' present and future consumption. Distortions in the capital market will drive a wedge between the components of the above marginal equivalence, so that \( mrt \neq mrs \). Moreover, the rate of interest may not equal either the mrt or mrs. Furthermore, if the capital market is segmented, there may be a multiplicity of rates of interest.

74. Two basic sources of distortions have been identified as causing the divergence between the mrt and mrs of present and future consumption. One is due to the presence of externalities, the other to the presence of monopolistic and/or fiscal distortions in the capital market. We will consider the causes and adjustments for the former type of distortion, the causes of the latter type being self-evident, and the remedies being similar to those suggested for the former type.
75. The source of the externality in the capital market is due to the interdependence and the mortality of private savers. Being mortal, they cannot be expected to extend their altruism to the infinite generations which are properly the concern of a society, which at least in principle, is immortal. As a result, the savings (future consumption) generated, ceteris paribus, as a result of the decisions of private savers is likely to be less than socially optimal. Furthermore, if private savers knew that everyone else were going to save at the socially optimal rate, then they too would agree to save at this rate. Hence, the externality. The result is that the private rate of time preference is higher than the social. Under laissez faire, a perfect capital market would insure that enough savings would be invested until the social return to investment (savings) fell to the private rate of time preference. That is the private marginal rate of substitution (mrs_p) in consumption would be equated to the private and ex hypothesi, social, marginal rate of transformation (mrt) in production, of present into future consumption. However, as the externality causes the marginal private rate of substitution to be higher than the marginal social rate of substitution (mrs), we have mrs_p = mrt > mrs.

76. Once again the first best solution would be to cure the above divergence, by appropriate tax-subsidy policy; in this case by using fiscal policy to raise the savings rate in the economy till mrs_p and mrt had become equal to mrs. Note that as the savings level is raised toward the optimal level, mrs will rise and mrs_p and mrt will fall.

77. However, the government may have imperfect control over savings in the economy, and may not be able to legislate the optimal savings rate by direct fiscal means. In that case, it will be necessary to take account of
the divergence in the MRT and MRS in the capital market. As long as the
divergence exists, current savings are socially more valuable than current
consumption. Hence, if the government can indirectly, through its choice
of projects, influence the savings rate, this 'savings constraint' may be
overcome over time till savings and consumption are considered to be equally
socially valuable. The way in which the government could influence the
savings-consumption balance of the economy through project choice is by
influencing the choice of techniques and by choosing projects whose benefits
tend to be saved and reinvested rather than consumed.

78. The way in which both the UNIDO and LM procedures take account of
the divergence is by differentially weighting the project's net benefits
which are consumed and those which are saved. The only difference between
the procedures in principle is the difference in numeraires. Whereas (a) the
UNIDO procedures use present consumption as the numeraire, and put a premium on
savings, (b) the LM procedures use current savings as the numeraire, and
penalize consumption. To see this, consider the following simple algebraic
eexample.

79. **Algebraic Example**

80. (a) First, consider the procedure adopted in the UNIDO Guidelines,
which takes consumption as its numeraire. Assume that the net benefits
from a project in any year \( t \) are \( B_t \), and that of these \( y\% \) in any year are
saved and reinvested and \((1-y)\%\) are consumed. The social rate of time
preference today is \( d_0 \), and the social return to investment today is \( r_0 \) \((r_0 > d_0)\).
Moreover, over time the divergence between \( r \) and \( d \) is likely to diminish,
till \( T \) years from today the divergence will disappear (the level of savings
will be optimal). Finally, the project incurs capital costs of \( K \) in the base
year, yielding the stream of net benefits for \( N \) years.
81. To obtain the social profitability of the project we first note that the opportunity cost of the capital costs $K$ is the present value of the future consumption which would have resulted if Rs $K$ of present investment were made at the current social rate of return to investment, $r_0$.

Thus, if Rs 1 of current investment, which is assumed to remain intact forever, leads to net output of Rs 1.1 in the next period, $r_0 = 1.1/1 = .1$. Part of this return ($y$) will be saved and invested. Hence, the increase in investment next year $(t=1)$ will be $\sum (1+r_0y) = r_0y$. Total investment next year will therefore be $(1+r_0y)$. The year after next $(t=2)$ investment will increase by $\sum (1+r_0y)(1+r_1) = (1+r_0y)r_1y$. Total investment in year $t=2$ will therefore be $\sum (1+r_0y)r_1y + (1+r_0y)r_1y = (1+r_0y)(1+r_1y)$. Hence, by year $t$, when the savings constraint ceases to operate, total investment would have accumulated to: $(1+r_0y)(1+r_1y)\ldots(1+r_{T-1}y)$. To get the present value of this accumulated investment which, ex hypothesi, is as valuable as an equal amount of consumption at $T$, we have to discount its value back to the present $(t=0)$ at the changing social rates of time preference ($d_0, d_1, d_2\ldots d_T$), period by period. This present value is:

$$(1+r_0y)(1+r_1y)\ldots(1+r_{T-1}y)/(1+d_1)(1+d_2)\ldots(1+d_T)\ldots(1)$$

82. In addition to this accumulated investment, the initial Rs 1 of investment will have resulted in consumption of $(1-y)(1+r_0y)$ in $t=1$; of $(1-y)(1+r_0y)(1+r_1y)$ in $t=2$; and hence in year $t$ of $(1-y)(1+r_0y)(1+r_1y)\ldots(1+r_{t-1}y)$. The present value of this stream of consumption is:

$$\sum_{t=0}^{T} \frac{(1-y)(1+r_0y)\ldots(1+r_{t-2}y)(1+r_{t-1}y)}{(1+d_1)\ldots(1+d_{t-1})(1+d_t)} \ldots(2)$$
Confining our time horizon to T, the present value of the stream of consumption made possible by Rs 1 of investment today (s₀) is then:

\[ s₀ = (1) + (2) \]  \[ (3) \]

The social opportunity costs of capital expenditure of K today are therefore \( s₀K \).

83. The benefits are \( Bₜ \) in year \( (t) \), of which \( yBₜ \) will be saved and invested. The value of this savings in terms of consumption at date \( t \) will be given by the social opportunity cost of investment in year \( t \), which on an analogous argument to that for deriving \( s₀ \), will be \( sₜ \). The rest of the benefits \( (1-y)Bₜ \) will be consumed in year \( t \). Hence, the present value of the stream of net benefits will be given by:

\[ \sum_{t=0}^{N} \frac{(1-y)Bₜ + sₜyBₜ}{(1+d₁)(1+d₂)...(1+dₚ)} \]  \[ (4) \]

and the NPV of the project will be given by:

\[ NPV = (4) - s₀K \]  \[ (5) \]

Thus on the 'generalised' UNIDO procedures it is necessary to know both the changing social return to investment (the \( rₜ \)'s) as well as the changing social rates of discount (the \( dₜ \)'s). Moreover, the discount rate used to obtain the NPV of the project will be the social discount rates \( dₜ \)'s.

84. (b) The alternative LM procedure takes savings as its numeraire, and uses the own rate of return on investment (called the accounting rate of interest ARI) as the discount rate. However, as we will show, it is identical

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1/'generalised' because, as the next section explains, the way in which \( s \) is calculated on the UNIDO Guidelines assumes that its value remains constant over time. This, in practice is likely to be an implausible assumption. But as the above account suggests, the UNIDO approach can be generalised, so that it is identical to the LM one, except for the change in numeraire.
to the 'generalised' UNIDO procedures, except for the change in numeraire. Following the same argument as before, and making the same assumptions, we found that Rs 1 of investment yielded a present value of total future consumption generated by the investment of $s_0$. That is, Rs 1 of current savings (investment) is worth $s_0$ of present consumption. Consumption therefore has $(1/s_0)$ the value if the same resources had been invested. In year 1, therefore, the value of $(1-y)(1+r_0y)$ consumption generated is $(1-y)(1+r_0y)/s_0$. In year $t$, the value of the consumption generated from the net benefits of the project will be $B_t(1-y)/s_t$.

In each year there will also be $yB_t$ savings generated, and these will be valuable at par, as savings is our numeraire. The total value, in terms of savings of the net benefits in any year, will then be:

$$B_t(1-y)/s_t + yB_t$$

These total savings benefits in each year have then to be discounted back to the present at the accounting rate of interest, $(1 + \text{ARI})^{-t}$ in each period to get the present savings value of the project. Hence, the NPV of the project on the LM procedures will be given by:

$$\text{NPV} = \sum_{t=0}^{N} \frac{B_t(1-y)/s_t + yB_t}{(1-p_t) \cdots (1+p_{t-1})(1+p_t)} - K \cdots (6)$$

Note that as savings is our numeraire, the capital costs $K$, incurred in year 0 are valued at par.

Moreover the IM Manual derives a relationship between $p_t$, $s_t$, and $d_t$. It is:

\[ \text{ARI} = \frac{0.05}{1} = 0.05 \]

Thus, if say Rs 1 of investment today leads to a net return of Rs 0.1 tomorrow, of which half (.05) is saved and invested, and if consumption has no social value in terms of the numeraire savings, then the ARI is $.05/1 = .05$. If on the other hand, consumption and savings are considered socially equally valuable, then the ARI would be $.1/1 = 0.1$. In general if the value of one unit of consumption in terms of savings is $1/s$, the ARI in this example will be $(.05 + .05/s)$. 

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1/Thus, if say Rs 1 of investment today leads to a net return of Rs 0.1 tomorrow, of which half (.05) is saved and invested, and if consumption has no social value in terms of the numeraire savings, then the ARI is $.05/1 = .05$. If on the other hand, consumption and savings are considered socially equally valuable, then the ARI would be $.1/1 = 0.1$. In general if the value of one unit of consumption in terms of savings is $1/s$, the ARI in this example will be $(.05 + .05/s)$. 

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\[ \frac{s_t}{s_{t+1}} = \frac{(1+p_t)}{(1+d_t)} \quad \ldots \ldots (7) \]

87. (c) Now consider a two period case, that is from \( t=0 \) to \( t=1 \).

For the project to be acceptable on the LM criterion, the NPV given by (6) should be positive, that is:

\[ B_1 \left\{ (1-y)(1/s_1) + \frac{y}{(1+p_1)} \right\} \geq K \quad \ldots \ldots (8) \]

Multiplying both sides of (8) by \( s_1 \), and then dividing both sides by \( s_1/s_0 \), we get:

\[ \frac{B_1 \left\{ (1-y)(1/s_1) + \frac{y}{(1+p_1)} \right\}}{s_1/s_0 \cdot (1+p_1)} \geq s_0K \quad \ldots \ldots (9) \]

From (7) the denominator of the LHS of (9) is equal to \((1+d_1)\), hence, we get (9) equal to:

\[ \frac{B_1 \left\{ (1-y)(1/s_1) + \frac{y}{(1+p_1)} \right\}}{(1+d_1)} \geq s_0K \quad \ldots \ldots (10) \]

as the criterion for accepting a project on the LM procedure.

88. But now consider the same two period case on the UNIDO procedures; the acceptance criterion is that the NPV given by (5) be positive; and it can be seen from (1b) and (5) that this gives the identical result (10) as the criterion of acceptability. Hence, the two procedures LM and UNIDO are identical in terms of the information needed to take account of sub-optimal savings. The differences in the discount rates on the two procedures (the ARI on the LM, the social rate of discount on the UNIDO) merely reflect a change in numeraire.

89. **LM and UNIDO in Practice:**

90. To show the equivalence in principle of the two procedures, in the above algebraic example, we had assumed that the value of \( s \) is calculated on
the UNIDO procedures on the LM assumption that savings and consumption will be equally valuable T years from today. In practice, however, the formula given by UNIDO to calculate the value of s assumes that the divergence in the relative social value of aggregate consumption and savings, and hence the value of s remains constant till infinity. Thus the UNIDO formula for calculating s is:

$$s = \frac{(1-y)r}{(d-yr)}$$

where
- $y$ = marginal propensity to save,
- $r$ = rate of return on investment, and
- $d$ = social rate of discount of consumption.

(See \[32\], p. 175 onwards). This equation will only provide meaningful values if $d > yr$, otherwise the social value of investment (s) will be infinite (See \[32\], p. 189). There is no plausible economic reason why d must necessarily be greater than yr\(^1\). Moreover, the actual value of s given by the formula will be very sensitive to the values chosen for d, y and r, and small differences in the values of these variables could lead to large differences in the value of s.

91. The assumption of a constant divergence in the relative social values of aggregate consumption and savings, and hence a constant s must therefore be rejected in favour of the more plausible LM assumption that this divergence disappears after T years and hence s will typically fall over time to a value of unity at T.\(^2\)

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1/ Thus Maurice Scott points out that "one could argue that d should be zero in Mauritius (with per capita consumption roughly constant) while y and r are both positive."

2/ Another consequence of assuming a constant s ($s_t = s_{t+1}$) is that from (7) above the discount rate ($p_t = d_t$) is the same on both LM and UNIDO procedures.
92. Finally, it should be emphasized that both procedures require information on the social rate of discount and the social rate of return to investment in the economy. Computation of both these rates is extremely difficult in practice, but if non-optimal savings levels are sought to be effected by project choice, there is no alternative to making estimates or guesses of these parameters. As I have dealt at length with methods of estimating these parameters elsewhere (see Lal [22]), I shall not deal with these problems in this paper.

B. Labour

93. One of the most common forms of distortion identified in the project evaluation literature is in the labour markets of surplus labour economies, such that the wage rate does not equal the social opportunity cost of labour in the economy.

94. Two components have been traditionally identified in the social opportunity cost of labour in surplus labour economies. The first is the output foregone elsewhere in the economy, as a result of employing labour on the project. The second are the costs in terms of increased aggregate consumption that may result as more labour (which consumes most of its income) is employed on the project. If, due to the non-optimality of savings (discussed above, present consumption is socially less valuable than current savings, then any increase in aggregate consumption, caused by increasing employment as a result of the project, will not be as valuable as the equivalent amount of savings. This factor will have to be reflected in the measure of the social opportunity cost of labour.

95. To concretise this, consider a particular formulation of the social opportunity cost of labour, that is the shadow wage rate (SWR) due to LM.

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1/ This section is based on Lal [18], where a fuller treatment of the subject may be found.
Except for a change in numeraire, which LM take to be 'savings' rather than consumption, their analysis is similar to other well-known ones due to Sen and Marglin, and which have been incorporated in the UNIDO procedures.

96. Assume first that the wage paid to a labourer in his new job, c, is above the output foregone elsewhere by moving him from his previous employment, m. Secondly, given the non-optimality of savings, and taking savings as the numeraire, one unit of current consumption is socially worth \((1/s)\) units of current savings. The \(s\) factor is the same as in the discussion of capital in the previous section. Then, the costs of employing one more person in the economy (in terms of savings) are given by:

\[
\text{SWR} = m + (c - m) - (c - m)/s
\]

The first term on the RHS is the output foregone elsewhere in the economy, which has been traditionally identified with the marginal product of labour in agriculture. In addition, assuming that workers in both industry and agriculture consume all their incomes, there is the cost of the extra consumption \((c - m)\) the economy is committed to as \(c > m\). But not the whole of this increase in consumption is a social cost, as society does value \(s\) units of consumption as equal in social value to one unit of savings.

Hence, from the total increase in consumption, a proportion \(1/s\) must be subtracted to get the net social cost (in terms of the numeraire, savings) of the increased consumption. The above expression reduces to:

\[
\text{SWR} = c - (c - m)/s
\]

97. (a) Output Foregone

98. In most traditional analyses the output foregone \(m\), in the above SWR formulation, has been identified with the marginal product of the relevant labour in its previous employment. Whilst this would, given certain other assumptions to be discussed, be correct for labour which was previously in
wage employment, it may not in general be correct for labour which was previously self-employed. This is an important consideration, in view of the fact that in most developing countries a substantial portion of the labour force is self-employed.

Moreover, in most traditional analyses it was also assumed that the marginal product of the labourer withdrawn from the traditional sector, agriculture, would be zero and hence \( m = 0 \). In a definitive analysis of dualism and surplus labour within a model of family farms on which there is equal \( w \) and income share and which explicitly incorporated leisure as an argument in the individual peasant's utility function, Sen [28] demonstrated that zero marginal productivity was not a necessary condition for the existence of surplus labour. The necessary and sufficient conditions being given by a constant disutility of effort, which implies a constant marginal rate of substitution between income and leisure over the relevant range of hours worked per man, in the traditional sector. Given this, output in the traditional sector would not fall with the withdrawal of workers, and hence for them \( m = 0 \), even though the marginal productivity of labour was positive in the traditional sector. Thus, in general, for a family farm worker withdrawn from a farm without any hired labour, the change in output will not equal his marginal product.

(b) Divergence Between Average and Marginal Costs

However, certain writers have noted [17] that the traditional analysis may underestimate the extra consumption cost of industrial labour. This is due to the assumption made in these analyses that 'agricultural' workers can be hired by the 'industrial' sector at a constant real wage \( (w_i) \), which is either given by a constant institutional wage, or else by a constant supply price of labour to the industrial sector. Dixit [7] suggests that this
assumption may be unrealistic, especially if there are terms of trade effects following a withdrawal of labour from agriculture. Then, if the industrial labour market is competitive, the supply price of labour to industry and hence the industrial wage will rise with increased industrial employment.\(^1\) This will create a divergence between the average \(\bar{c}\) and marginal \((c + \Delta c)\) cost of hiring industrial labour. The extra consumption the economy will be committed \(\Delta y\) will then be given by the difference between the marginal cost of hiring \((c + \Delta c)\) and output foregone, \(m.\)^2

\(^1\)In the simple closed economy two sector model analysed by Dixit \cite{Dixit1977}, the supply price of industrial labour is equal to the income foregone by agricultural family workers moving to industrial jobs. In short run equilibrium their income foregone is determined by the average physical product of labour in agriculture (assuming equal income sharing amongst family farm workers) and the relative price of agricultural output. With the withdrawal of an agricultural worker, the average product of labour in agriculture rises, whilst total agricultural output (assuming no surplus labour) falls. This last factor leads to a rise in the relative price of agricultural output. The net effect is to raise the average value product of labour in agriculture and hence the supply price of labour to the industrial sector.

\(^2\)This can be seen heuristically from the accompanying diagram. \(O\) is the industrial production function, with a given fixed capital stock and variable employment \((N)\). The \(OY\) curve gives the total output foregone, and the \(O\overline{W}\) curve the total wage bill for each level of industrial employment. The shape of both these curves reflects the assumed rising output foregone and wage rate (agricultural income foregone) of industrial labour. Assume that there is an infinite premium on savings, and all wages are consumed. Social welfare is then maximised with the industrial employment level \(ON^*\), where the marginal wage cost \((\text{slope of the tangent at } W)\) is equal to the marginal product of labour \((\text{slope of the tangent at } P)\). Hence to ensure the optimal level of industrial employment, a wage tax of \(WS/ON^*\) will have to be imposed. The slope of \(OS\) being equal to the slope of the tangent at \(W\). The SWR is then given by \(SWR = \frac{\Delta WS}{\Delta ON^*} = \frac{\Delta W}{\Delta N^*} = c + \Delta c\).

Fig.1.

\[\text{Output}\]
\[\text{N employment}\]

It is then easy to determine that when \(s > 1\), but not infinite, the SWR will be given by expression (B-3) in the text, where \(m\) is also interpreted as the marginal output foregone.
102. Hence:

\[ SWR = (c + \Delta c) - \frac{(c + \Delta c - m)}{s} \]

and if the premium placed on savings is very high \((s \to \infty)\), the SWR will be higher than the market wage \((\ldots)\). Note, however, that if there is a constant institutional wage \(w\) in the industrial sector, then \((\ldots)\), and the SWR will be given as before by (B-2).

103. (c) Rural-Urban Migration

104. Furthermore, as certain models of the labour market in developing countries have emphasized, the impact on net output in the economy cannot be deduced from the impact effects on output in the sector from which the new worker may be withdrawn. Hence, to obtain the value of \(m\), it will be necessary to trace through all the indirect effects, in terms of the rural-urban migration that may ensue, as the result of creating one new job in say the industrial sector. Thus, if for instance we have say a labourer \(A\) moving to the project and his wage in his previous employment was \(w\), and on his moving to the project his previous job is filled by someone else, \(B\), who in turn moves from a job which paid him \(y\) (\(w > y\)), then the change in output (assuming that the two wage rates are determined in competitive markets for hired labour) by employing \(A\) on the project is not \(w\) but \(y\), as now the first round effect of \(A\)'s migration - a fall of output of \(w\) in his previous employment - is offset by a rise in output in his previous activity by an equivalent amount when the other worker \(F\), replaced him, but which now results in the loss of output as a result of \(B\)'s movement from his initial job to \(A\)'s previous job of \(y\).

105. Furthermore, as a result of creating one more job in the 'industrial' sector, more than one migrant may move from rural areas. If \(N\) people migrate, and the change in agricultural output as a result of one person's migration
is \( Y \), then the

\[ SWR = c - \frac{(c-NY)}{s} \quad \ldots \ldots (B-4) \]

Harberger \(^{127}\) has used one particular model of rural-urban migration due to Harris-Todaro \(^{127}\), to derive the \( SWR \) as always equal to the market wage \( c \). This is obtained as follows. Harris-Todaro assume that there is no surplus labour in agriculture. The migrants come to the cities because the expected income in the urban sector is just equal to the income they forego in agriculture. The expected urban income is determined by the probability \( (P) \) of finding urban employment at the industrial wage \( c \), which, in the Harris-Todaro model, is determined by the equilibrium ratio of employed to the total labour force in the cities, say \( P_1 \). Furthermore, it is assumed that agricultural workers receive their marginal product (say \( a \)). At the margin, therefore, migrant workers will equate their marginal product (incomes) in agriculture, \( a \), to the expected wage in towns, \( P_c \). (That is, \( a = P_c \)). When one more man is hired by the industrial sector the expected wage \( P_c \) rises as \( P \) rises. This induces rural-urban migration of \( 1/P \) workers, which restores the probability of finding a job in the urban sector to \( P \), and the expected income to the equilibrium level \( P_c \), when rural-urban migration ceases. Hence in expression (B-4) \( N = 1/P \). Moreover, the 'equilibrium' value of \( P \) is \( a/c \) (given the migration function \( a = P_c \)), and as the output foregone per migrant on Harris-Todaro assumptions is the marginal product \( a \), we have:

\[ \text{See } \textnormal{Harberger }^{117}, \text{p. 128. This is also the assumption made by Harberger }^{117}, \text{p. 570. This formulation of } P \text{ is unrealistic. A more likely determinant of the chances of a single migrant is given by the number of vacancies occurring per unit of time divided by the number of candidates for those vacancies, that is the urban unemployed. The latter in fact was the determinant of } P \text{ in the earlier Todaro formulation (See }^{117}, \text{p. 142). But note that whilst these differing determinants of } P \text{ will affect the 'equilibrium urban unemployment' rate (which is the chief concern of other writers on rural-urban migration), the 'equilibrium' value of } P \text{ will be invariant to these alternative formulations of its determinants, as it will be determined by the rural-urban income differential. (In our formulation above, the equilibrium } P = a/c). \text{ For a fuller discussion see Lal }^{117}. \]
\[ m = NY = (1/P)a = c \]

Substitution in expressions (3-2) or (3-4) yields \( SWR = c \), the industrial wage. However, as has been pointed out above, in general it cannot be assumed that the change in output in the agricultural sector will equal the marginal product of labour. In that case, the change in output \( m \) within the Harris-Todaro migration model will be given by \( Y/P \), where \( Y \) is the change in output in agriculture when one worker is withdrawn. As before we have \( a = Pc \) (where \( a \) is the income the worker received in agriculture, which on a family farm would be equal to the average product of the farm if we assume equal income and work sharing on family farms). Hence \( m = Y/P = Y/a \) and the \( SWR \) given a Harris-Todaro type migration function will be:

\[ SWR = c - c(1-Y/a)/s \]

From this it is obvious that on the special Harris-Todaro assumption that \( Y = a \) the \( SWR \) will equal \( c \), the industrial wage. This is the Harberger derivation of the \( SWR \), in his "Panama" example (see [127] p. 568 and following). More important however, the Harris-Todaro-Harberger migration model is also restrictive in many other respects, some of which are more serious than others. First, it implicitly assumes that industrial wage-earners have tenure, as the rate of labour turnover in industry does not figure in their determination of \( P \). Empirically, this assumption may not be too inaccurate, as the rate of labour turnover does not seem to be very high in the industrial sector in most developing countries. Secondly, they consider the migration decision as a one-period decision, whereas strictly it should be a multi-period decision in which the present value of the costs of migration should at the margin be equal to the present value of the benefits from migration. If, however, as seems likely, most migrants have a fairly high subjective rate

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1/Todaro [317], p. 113, fn. 10, notes this.
of time preference (fairly short time horizon), then the use of a single period migration decision function may not be invalid. Thirdly, Harris-Todaro do not incorporate any of the costs of migration (real and/or 'psychic')¹ nor the relatively higher costs of urban living which the migrant would have to incur in their migration function. Finally, and most important, their migration model fails to take account of the existence of a fairly competitive 'unorganised' (services and small industry) sector urban labour market with high labour turnover and easy entry for new workers, which is typical of many developing countries, and which provides some income to the migrants whilst they are searching for an 'organised' (industrial) sector job at the high institutional wage c.

Thus it is essentially the last two features which need to be incorporated into a more general migration function. To derive the SWR for this more general migration model, we continue to assume that industrial wage earners can be taken to have tenure, and that a one period decision model is a fair approximation to reality. However, we now assume that in addition to the agricultural income foregone, a, the migrant has to incur migration costs of d, which include both the real and 'psychic' costs of migrating. Furthermore, if the migrant does not succeed in obtaining an industrial sector job at the high institutional wage of c, he can nevertheless find some employment in the 'unorganised' urban labour market and derive an income w. Finally, we assume that by living in the town the migrant has to incur a relatively higher cost of living than in rural areas of u to maintain the same standard of living as he enjoyed in the countryside. If the chances of getting an 'organised' (industrial) sector job are as before P,

¹Though Harris-Todaro note the existence of these costs, see fn. 8.
then at the margin the migrant will equate the costs of migration, which
are given by \((a+d+u)\) with the expected benefits, \((Pc + (1-P)w)\), that is in
equilibrium:

\[
a + d + u = Pc + (1-P)w.
\]

This yields the 'equilibrium' value of \(p = (a+d+u - w)/(c-w)\).

108. As before, with the creation of a new industrial sector job
\(N=1/P\) migrants will move from agriculture, and as the output foregone per
migrant in agriculture is \(Y\), we have the total output foregone, \(m = Y\).

\[
(c-w)/((a+d+u-v),
\]

and in this more general and more realistic migration model, the conclusion
drawn by Harberger that the institutionally given industrial wage \(c\), is
the shadow wage, will not be valid.

109. (d) Disutility of Effort

110. Finally, in addition to changes in output, there will also be
changes in the aggregate disutility of effort \(E\) with increased employment.
To evaluate these, assume initially that there are no imperfections in the
labour market. Then, at the margin, utility maximising workers will equate
the disutility of increased effort with the utility from the increased
incomes (which we assume are all consumed) this extra work makes possible.
That is, the extra disutility of effort \(E\) must equal the change in workers'
consumption (including those left behind on the farm) which is given by
\((c-m)\) - the difference between the industrial wage (assuming the new job
is in industry, and the worker moves to it from agriculture) and the total
output foregone by employing one more man in the industrial sector. The
value in terms of savings of this change in disutility of effort (which so
far is in terms of consumption equivalents) is \((c-m)/s\). If the value society
places on the disutility of effort is \(\lambda\), then the SIR incorporating the
costs of the disutility of effort will be:

\[ \text{SWR} = c-(c-m)/s + \lambda (c-m)/s \]

\[ = c-(c-m)(1-\lambda)/s \quad \ldots \ldots \quad (B-6) \]

111. Next relax the assumption that all labour markets are competitive, and assume that there is an institutional wage, \( c \), in the sector to which the labour is moving which is above the supply price of labour \( L \). The latter term includes all the private disutilities that may attach to the new job. Our earlier expression for the consumption equivalent of the net change in disutility \( c-m \) will now be overstating the true change in disutility by \( c-L \), which is the difference between the institutional wage \( c \), and the supply price of labour \( L \). The net change in disutilities in this more general case will therefore be given by \( c-m-(L-m) = (L-m) \), and as before the value in terms of savings will be \( (L-m)/s \), and the

\[ \text{SWR} = c-(c-m)/s + \lambda (L-m)/s \quad \ldots \ldots \quad (B-7) \]

If \( \lambda = 0 \), that is society places no value on the change in the private disutilities of effort, we get the traditional \( \text{SWR} \) as in \((B-2)\) above. If, however, it is assumed that society should value disutilities of effort at their private costs, then \( \lambda = 1 \), and the

\[ \text{SWR} = L + (c-L)(1-1/s) \quad \ldots \ldots \quad (B-8) \]

The first term is the supply price of labour, the second is the value in terms of savings, of the extra consumption generated by the excess of the institutional wage over the supply price of labour. Thus, when \( \lambda = 1 \), we get the standard neo-classical result, that the \( \text{SWR} \) will be the supply price of labour, if there is no divergence between the social value of present consumption and savings, that is \( s=1 \); and furthermore, that if \( c=L \), that is if labour markets are competitive, the \( \text{SWR} \) will equal the market wage \( c \), no
matter what the value of s, and irrespective of any divergence between m
(the output foregone elsewhere in the economy), and the industrial wage c.1/

(e) **Alternative Formulations of the SWR**

We can now, very succinctly, compare the various alternative SWR's
that have been suggested in the literature.2/

1/Introducing rural-urban migration a'la Harris-Todaro-Harberger, we know
that with the employment of one extra worker in industry, 1/P workers
will migrate, whose total supply price will be a/P (as a is the income
foregone in agriculture by the migrating worker). Also if the output
foregone per worker migrating from agriculture is Y, then the total output
foregone with 1/P migrants is Y/P. We also have the equilibrium migration
condition that P=a/c (where c is the industrial wage), and we know from
the above discussion that the net change in disutilities is given by the
total supply price of labour and the output foregone, that is by (in this
case) (a/P - Y/P) = c(1-Y/a), after substituting the value of P=a/c. The
social value of this cost of the increased disutilities of effort, in
terms of savings will be \( c(1-Y/a)/s \), and hence the SWR in the Harris-
Todaro-Harberger type migration model will be:

\[
\text{SWR} = c - c(1-Y/a)/s + \lambda Y(1-Y/a)/s = c - c(1-Y/a)(1 - \lambda)/s
\]

Once again if we make the Harris-Todaro assumption that \( Y=a \), then the
SWR = c, the industrial wage, irrespective of the values of \( \lambda \) and s.
Whilst if \( \lambda = 1 \) (which is Harberger's assumption), then irrespective
of the value of s and any divergence between Y and a, the industrial
wage c, is again the SWR.

In our more realistic migration model however, the supply price of each
migrant is \( (a+d+u) = L \). The number of migrants with each industrial job
created are \( N=1/P = (c-w)/(L-w) \). The net change in disutilities socially
valued is then \( \lambda (LN-YN)/s = \lambda [(L-Y)(c-w)/(L-w)]/s \), and the SWR is:

\[
\text{SWR} = c - \lambda c - \lambda Y(c-w)/(L-w)]/s
\]

If \( \lambda = 0 \), the above expression reduces to (3-5) above, whilst if \( \lambda = 1 \)
the SWR = c - \( \lambda (c-w)/(L-w) \)/s, and once again none of the simpler
derivations of the SWR of the Harris-Todaro and Harberger types will hold.

2/As most writers have not included rural-urban migration in their models for
determining the SWR, this aspect is neglected in this section. The
previous section has already dealt with the SWR's derived or derivable from
the Harris-Todaro-Harberger type models and a model developed in Lal [187].
First, there is the view due to Galenson-Liebenstein /107/ and Dobb /67/ that the SWR is the market wage, that is $\text{SWR} = c$. For this to be the case, either $c = mL$, or $m = 0$, $s \to \infty$, $\lambda = 0$ or $E = 0$.

Secondly, there is the view associated with Kahn /157/ and Lewis /237/ that the SWR = $0$. For this to be the case: $m = 0$, $s = 1$, $\lambda = 0$, or $E = 0$.

Thirdly, for Sen /297/, Marglin /267/ and to some extent UNJIO /327/, the SWR = $c - c/s$. For this to be valid: $m = 0$, $\lambda = 0$ or $E = 0$.

Fourthly, the LM /247/ SWR is given by (B-2) above, $\text{SWR} = c - (c - m)/s$. For this to be valid: $\lambda = 0$. As they assume a positive marginal product in agriculture, $E$ cannot be zero.

Finally, for Harberger /127/, the SWR is the supply price of labour $L$, that is $\text{SWR} = L$. For this to be valid: either $\lambda = 1$, $c = L$, or $s = 1$.

Part of the differences relate to empirical matters, that is the value of $m$ and $E$. But, in part, the differences relate to two value parameters, $s$ and $\lambda$. The reasons why it may be necessary to take $s > 1$ have been given in the section on capital above. A number of reasons have been advanced by the present author, why it may also be desirable to assume that $\lambda = 0$, for developing countries. /1/ However, the values assigned to these parameters must be in the nature of value judgements, and hence the possibility of conflicting advice on the different procedures. However, as this section has tried to show, if the same assumptions and value judgments are made, the alternative procedures will give identical answers, based upon the general expression for the SWR provided by (B-7) above.

/1/See Lal /787/.
III. INCOME DISTRIBUTION AND EMPLOYMENT

120. Traditionally questions of equity have been separated from those of efficiency in project analysis. This corresponds to the concern of theoretical welfare economics with Pareto improvements which assume a given income distribution, and its inability to provide any value-free criteria for welfare improvements which involve distributional considerations. Strict adherents of traditional welfare economics therefore are loth to include the questions of equity into the supposedly value-free efficiency criteria that can be derived from welfare economics, on the grounds that the economist qua economist has no special expertise in dealing with equity questions which involve value-judgments, and hence he should stick to his last. Harberger has recently postulated three basic postulates of applied welfare economics, the third of which says: "when evaluating the net benefits or costs of a given action (project, program, or policy), the costs and benefits or costs accruing to each member of the relevant group (eg, a nation) should normally be added without regard to the individual(s) to whom they accrue."

121. In contrast with this view, there is a growing feeling amongst the practitioners in the development field that some account needs to be taken of the distributional impact of projects. The argument is that it is only if (on the lines of traditional welfare economics) the government can legislate the optimum income distribution independently of project choice, that the problems of equity and efficiency can be separated. The efficiency effects of projects would then be the only concern of the project evaluator, as they would determine whether or not the project represented a Pareto improvement; the income distribution effects of the project being neutralized.
by appropriate tax-subsidy measures. However, if there are constraints on fiscal policy and the above measures to attain the optimal income distribution are infeasible, project choice itself becomes an instrument of government policy in changing the income distribution in the desired manner. Income distribution considerations, therefore, may need to be taken into account for second best reasons, in project analysis.

122. The next question then is whether these distributional effects should be taken account of in a systematic manner in project analysis, by differentially weighting the project benefits and costs in terms of the individuals who receive or incur the costs and benefits. Or should the distributional effects merely be described (and if so, how), along with the calculation of the efficiency rates of return; leaving the weighting of the distributional effects, and any trade-off there may be between them and the efficiency rates to return to the policy maker? The disadvantages of following the latter course are that it is likely that distributional effects will be taken into account in an ad hoc manner - the implicit weights varying inconsistently from project to project.

A. Determining Distributional Weights

123. If then distributional effects are to be taken into account, how should this be done? Note firstly that there are at least two dimensions to the distributional effects of projects. The first consists of the intertemporal distribution of benefits, which will be determined by the division of the

1/ However, even in this case, if the administrative costs of fiscal redistribution are not negligible, it may be necessary to take account of the distributional effects of projects, as project selection will provide an alternative redistribution mechanism (with possibly lower administrative costs) than that provided by the fiscal mechanism.
project's incomes between current consumption and savings. This was the aspect we have already discussed in our discussions of distortions in the capital market in the last section. As long as the government feels that the present level of savings is not optimal (the growth rate of the economy is not optimal) and wants to use project choice to raise the level of savings, then it is implicitly saying that present consumption is less socially valuable than future consumption (savings). The way in which this aspect can be taken into account in project analysis has already been discussed in the section on capital, and we will not discuss it further, except for noting one important feature of the necessary adjustment.

124. The value of $s$, that is the premium on current savings over current consumption, which we had discussed, depends upon the solution of a Ramsey type formulation of intertemporal optimality, which requires the specification of an intertemporal social welfare function. Given such a welfare function which determines the distributional weights to be attached to consumption accruing to different generations (the values of $d_t^{1/}$, the same welfare function can be used to derive distributional weights to be attached to consumption accruals amongst contemporaries within a generation. Thus distributional weights which reflect both the intertemporal and intratemporal distributional considerations can be derived. The present author has derived such weights for India (which also take account of regional income-differentials) (see Lal [197]). However, these weights necessarily depend upon explicit value judgments - in the above case on the value of the elasticity of marginal utility of a constant elasticity utility function which is used to value consumption increases both intertemporally and

$1/d_t$ is the social rate of discount (LM consumption rate of interest) in period $t$, as explained above in Section II.A on Capital.
intratemporally. Various alternative values of this value parameter can be tried out. The policymaker can then make his choice by examining the quantitative implications of different values of the parameter.

For many, however, such a procedure will appear to be akin to 'mathematical politics'. An alternative would be to include only the intertemporal distributional (growth) aspects in the rate of return, and in addition present a meaningful statistic which would provide the policymaker with the important intratemporal distributional features of the project, which he could then implicitly weight against the efficiency cum growth rate of return of the project.

B. The Employment Problem

In deriving such a statistic it may be useful to consider another seemingly different problem which has been suggested as worthy of inclusion as an objective in project choice - employment. The employment problem in developing countries is essentially the problem of poverty - of raising the incomes of large numbers of people who are below some national poverty line.

There are other aspects of the employment problem, namely the efficiency aspects which relate to the surplus of labor time which may be available for productive employment if the supply of cooperating factors of production could be increased. This is the aspect which will be taken into account by the efficiency SWR's we discussed in the section on distortions in the labor market. This is also the growth aspect of employment which is connected with the implications of increasing employment on the consumption-savings balance of the economy when the level of savings is non-optimal in the economy - a subject we have discussed in the section on distortions in the capital market. (This is also the aspect concerned with the intertemporal distribution of project benefits). Over and above these
there may still be an employment problem in the sense that it may be
desirable to choose projects whose benefits accrue to 'poor' people as the
 provision of 'employment' on the project may be the only feasible way of
increasing their incomes.

127. The relevant distributional statistic from this poverty viewpoint
will be the numbers of the poor who are benefited by the project. Such a
statistic, labelled the poverty redressal index (PRI), has been developed
by the present author (see Lal [26]). It gives the number of people below
the poverty line, per unit of annual domestic resource cost, whose annual
incomes are raised in perpetuity by the project. The PRI requires only
minimal value judgments, and is relatively easy to compute. It could be
used as a crude measure of the most important distributional effects of
projects - the numbers of the poor whose incomes have been raised by the
project per Rs expended.

128. If more sophisticated distributional considerations are required to
be incorporated into project choice, then specification of the social welfare
function and the derivation of differential weights is unavoidable.

129. In conclusion, it should be noted that both LM and UNIDO are in
agreement that differential income distribution weights should be used in
project analysis, and that the 'employment problem' in developing countries
is chiefly a problem of income distribution and poverty.
IV. DEBT SERVICING AND BALANCE OF PAYMENTS PROBLEMS

130. One of the serious practical problems facing many developing countries is the servicing of their past debts, and many people are puzzled by the seeming neglect of the debt servicing problem in investment appraisal criteria. We shall show that this is not the case and that both the basic evaluation procedures - the IM and the UNIDO SER methods - implicitly take account of it.

131. First note that the debt servicing problem is just the old 'transfer problem' and the requirements for affecting a requisite transfer are identical to the requirements for the correction of an equivalent trade imbalance. Hence the welfare costs of effecting a given transfer (which would have to be taken into account in project analysis) are identical to the welfare costs of correcting an equivalent balance of payments deficit.

132. Now consider the IM procedures. They revalue all inputs and outputs (current and future) in terms of foreign exchange. Debt service charges (and capital inflows) are included as foreign exchange costs/benefits in the year they are incurred. The foreign exchange benefits which form the net social benefit of the project in any year are therefore not of the debt service charges. Debt servicing is therefore directly included in the time stream of the costs of the project.

133. On the SER method, again the debt service charges are included in the costs of the project. But as these procedures use domestic currency as the numeraire, the foreign currency value of the debt service costs has to

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1/ The 'transfer problem' concerned the real costs of effecting foreign transfers (specifically reparations from Germany in the inter-war debates).

2/ This assumes that the foreign loan is tied to the project. If the loan is not tied to the project, the country has first to decide whether that
loan is worth accepting given the ARI, and various other national parameters. In this calculation the net social benefits to the country from the loan taking account of inflows and outflows on the foreign capital account, and of the likely future balance of payments and savings positions are obtained on the assumption that the loan will be invested to earn at least as much as the ARI. If in general the loan is acceptable, at the second stage a particular project will be evaluated conventionally and accepted as long as it has a positive NPV at the ARI. Thus, the debt servicing problem will have been taken into account at the first stage. For a discussion of this type of calculation and the derivation of the relevant rules see D. Lal: 'When is Foreign Borrowing Desirable?', Bulletin of Oxford Institute of Statistics, August 1971.
be converted into domestic social costs at the SER in that year. The net social benefits in the time stream of benefits and costs of the project will therefore be net of the debt servicing charges.

134. In both procedures, if the social rate of return, taking account of these debt service charges is higher than the relevant discount rate, the project is acceptable, and ex hypothesi cannot create a debt servicing problem for the country. Hence the rates of return on both the IM and SER methods are full social rates of return which already include the debt servicing costs created by the project. No further adjustment therefore needs to be made for debt servicing on these procedures.

135. It may be felt however that in the future the country may be faced by a general debt servicing problem, which is equivalent to saying that in the future a general balance of payments problem is expected. How will the alternative procedures deal with this? The answer has already been given, in part, in our discussion of trade distortions, when we discussed how shadow prices would change on the alternative procedures with trade liberalization accompanied by a flexible exchange rate and fixed money prices of domestic (non-traded) goods. We will however for completeness spell it out in detail, this time in terms of textbook balance of payments theory.

136. It is well known that a balance of payments deficit \( B \) is exactly equal to the excess of domestic expenditure \( E \) over domestic output (income) \( Y \). That is, \( B = Y - E \). To cure this deficit it is necessary in general to use two instruments: one to switch the pattern of expenditure to domestic goods, the second to reduce the level of domestic expenditure. Assume that the government always maintains internal balance by appropriate expenditure reducing/increasing policies. In addition, to cure the balance of payments deficit, the pattern of expenditure will have to be switched, by some means, away from traded to non-traded (domestic) goods. If the price of domestic
(non-traded) goods is inflexible, the only way for this expenditure switching to take place is via an exchange rate change. As a result, the prices of traded goods, in domestic currency, will be higher in the post-, as compared with the pre-devaluation situation, and will also be higher relative to the price of non-traded goods, whose prices we have assumed remain constant. Working in domestic currency, therefore, the prices of traded goods will have to be multiplied by the anticipated post-devaluation exchange rate, to give the higher domestic currency equivalents in the post-devaluation situation, and hence the higher relative price of traded to non-traded goods which is necessary to cure the incipient balance of payments deficit caused by the transfer problem. Equivalently we could have obtained the correct relative prices of traded to non-traded goods by working in foreign currency and following the IM procedures. On the IM procedures as we have seen, the foreign currency costs of the MSC of producing the non-traded goods will be the shadow price of these goods. With an anticipated devaluation the foreign currency value of the MSC of producing the non-traded goods will fall. With the domestic money price of non-traded goods assumed constant, the fall in their foreign currency shadow price is equivalent to an implicit deflation of the domestic money price by the post-devaluation exchange rate (which is the post-devaluation SER on the alternative method).

137. To see how the foreign currency value of the MSC of production of non-traded goods falls with an anticipated devaluation, we have to consider what happens to the LM SWR with a devaluation. For the other costs of production are, ex hypothesi, tradeables (as the costs of production are broken down, until they comprise tradeables and labour on the IM method), whose foreign currency value is fixed, and will not alter with an exchange
rate alteration. The only component of the costs of producing non-tradeables, in foreign currency, which can change is the foreign exchange value of the SWR.  

138. From our discussion of labour above we have the LM SWR as $SWR = \frac{c-(c-m)}{s}$ where $c$ is now the foreign currency value of the money wage, $w$, labour receives. The supply of labour is moreover assumed to be elastic at this constant money wage, $w$. The alternative output foregone by using labour is also constant; its value in foreign currency being $m$. As before, $s$ is the premium on savings vis-a-vis current consumption. Thus all the components of the SWR are given in foreign currency, and hence the foreign currency value (shadow price) of the non-traded good is determined. With an anticipated devaluation, ceteris paribus, the foreign exchange value of the traded goods inputs, and the $m$ component in the SWR used to determine the costs of production of the non-traded good (in foreign currency) will not change. However, given our assumption of a constant money wage $w$, its foreign currency value $c$ will fall. Hence from the SWR formula it can be seen that for this reason the SWR will fall (in foreign currency), and thus the non-traded good price (in terms of foreign currency) will fall. This is the LM analogue to the SER procedures for taking account of the expenditure switching aspect of the balance of payments adjustment process.

139. There is in addition, however, another countervailing influence on the SWR. As noted above, in addition to the exchange rate change (for switching expenditure) there will also have to be a reduction in domestic expenditure to correct the incipient balance of payments deficit. If it is assumed that aggregate domestic consumption cannot be cut (a simplifying  

1/Assuming for simplicity, no skilled and/or self-employed labour.
the impact of the expenditure reduction must fall on domestic investment. But this must imply that the social return to investment, the LM accounting rate of interest (ARI), will rise. As aggregate consumption has not been affected, the social rate of time preference (the LM consumption rate of interest, CRI) remains constant. This implies that the divergence between the ARI and CRI (which determines the premium on current savings s) increases, and hence s rises. This increase in s, ceteris paribus, will tend to raise the SWR. The net effect on the SWR will thus be the result of the twin policies needed to correct an incipient trade imbalance: an exchange rate change (switch in the pattern of expenditure) which changes the value of c (measured in foreign currency) and a change in the level of expenditure, which changes the level of s by raising the ARI.

Finally, the rise in the ARI will mean that the cutoff IRR for accepting a project will rise, and hence the lower level of investment which

1\footnote{This can be clearly seen from equation (7) above (p. 46), where \( p_t \) is the ARI and \( d_t \) is the CRI.}

2\footnote{Strictly speaking our simplifying assumption that aggregate domestic consumption cannot be cut is inconsistent with our earlier assumption that the money wage is fixed, and hence the real wage falls with a devaluation. The fall in the real wage will obviously imply some fall in private consumption. This will tend to raise the LM consumption rate of interest (CRI), and for a given ARI will tend to reduce the divergence between the ARI and CRI (note that normally the CRI < ARI), and hence reduce s. The effect of the cut in investment and government expenditure, which will concomitantly be required to reduce total domestic absorption to improve the balance of payments, will be (as stated in the text), to raise the ARI, and hence for any given CRI to increase the divergence between the CRI and ARI and hence raise s. The net effects of expenditure reduction on s and hence on the SWR will then depend upon the opposing effects of cuts in private consumption and investment and government expenditure on s. On balance, however, the value of s is likely to rise with expenditure reduction necessary to improve the balance of payments, as the proportionate cuts in domestic investment and government expenditure will generally be more severe than those in private consumption. A rise in s, naturally, will lead to a rise in the SWR, as derived in the text.}
is needed to get the expenditure reduction will be achieved. But note that the cut in investment should be across the board, for with the shadow prices in the post-devaluation situation being used to evaluate projects, the relative shadow prices for all the goods are correct, and hence all investment projects which have a lower social rate of return than the higher AfI should be cut back.

141. Note that on the SER procedures too, the level of domestic expenditure has to be cut back, and given the same assumption about the inflexibility of consumption expenditure, the expenditure reduction must fall on investment, thereby raising the social return to investment, and raising the discount rate with which the IRR of projects should be compared.

142. Thus both the IM and SER methods take account of an incipient balance of payments (transfer) problem in equivalent ways, by first altering the relative price of traded to non-traded goods, and secondly by reducing domestic expenditure by raising the cut-off IRR for accepting projects.

142. There are therefore no special adjustments necessary on either method to take account of the debt servicing problems associated with specific projects, or with any general debt servicing (balance of payments) problem which may be foreseen in the future.
V. SECOND-BEST PROBLEMS AND DIFFERENTIAL TAXATION

143. In our discussion so far we have dealt with specific distortions in the domestic price system, and the adjustments these call for, in a piecemeal manner. It being implicitly assumed that apart from the particular divergences between MSV's and MSC's of goods and factors we have discussed, there are no other distortions in the economy. Suppose, however, as is likely in most developing countries, that (A) there are various other domestic distortions which the government cannot cure because its use of certain policy instruments is constrained as being infeasible, and/or (B) that whilst the government has complete control over the public sector, and can legislate the 'shadow' pricing rules therein, its control over the co-existing private sector is limited. What will be the correct shadow pricing rules to be adopted in such second-best situations?

144. The same problem can be put in a slightly different form by recognizing that one of the main sources of divergence between the MSV and MSC's of commodities/factors, is the domestic tax system. Most governments have to raise revenue for public and/or redistributive purposes by taxation. Theoretically, the only non-distortionary taxes are lump sum taxes. In practice, however, such taxes are infeasible. Given this constraint, the feasible set of taxes will necessarily cause a divergence between the MSV and MSC's of commodities/factors. What are the correct "shadow" prices to be used? The MSV's (the marginal rates of substitution or the demand prices), the MSC's (the marginal rates of transformation or the supply prices) or a weighted average of the two? It has been shown by Diamond & Mirrlees that, assuming that administrative costs are negligible, but all commodities
can be taxed, the correct shadow prices to be used are producer's prices (that is, the MSC's) of the relevant goods/factors. The quasi-optimal taxes for raising government revenue being differential taxes on final consumer goods. The argument can be seen heuristically in terms of a simple geometric model due to Diamond-Mirrlees. We assume an economy with a single consumer, who supplies labour to the government which is used solely to produce a single consumer good X, which is sold to the consumer in payment for his labour at an 'equilibrium' relative price of labour to consumer good X. The government needs to appropriate a fixed amount of the consumer's labour for its own purposes, but it cannot do so by levying a lump-sum tax on him. It can only raise the required resources by effecting the relative price of good X to labour by taxing the commodity X. What is the optimum production and tax configuration for this economy?

Fig. 1 shows the production possibility set describing the feasible output of good X which the government can provide the consumer in return for his labour (PP). The distance OP represents the amount of the consumer's labour resources the government wants to appropriate, and hence the PP curve will start from P and not the origin. The curve moreover has been drawn assuming diminishing returns to scale. (The argument applies equally to constant returns to scale as can be easily checked by drawing PP as a straight line). OC represents the locus of the points of tangency of
the consumers indifference curves (between labour effort and consumption of X such as ii) with the various possible relative prices of labour and X the consumer can face. It is thus the consumer's offer curve; and represents points of consumer's 'equilibrium'.

146. The government now has to choose a production point which is technologically feasible, which ensures consumer's equilibrium, and also maximises his welfare, subject to the restriction that the government must appropriate OP of his labour, but can only do so by commodity taxation (choosing the relative price of labour to good X). It must necessarily therefore choose point E. But E is on the production frontier and hence a productive efficient point. To sustain the production/consumption configuration at E, the consumer price of X to labour must be set at that given by the slope of the line OEQ, whilst the producer price must be set equal to the marginal rate of transformation in production at E, namely that given the slope of the line yy. The difference between the producer and consumer prices gives the quasi-optimal tax on commodity X (taking the wage rate of labour as the numeraire). Thus even though lump sum taxation is infeasible, production efficiency is desirable. The result carries over to a many-commodity, many-consumer economy where all commodities are taxable.

147. However it may not be feasible for governments to levy these quasi-optimal commodity taxes. Various alternative restrictions on the government's fiscal powers may then be considered relevant. Stiglitz and Dasgupta have considered models with a wide variety of restrictions on the government's fiscal powers. One obvious limiting case is one where it is assumed that all taxes are given and assumed to remain fixed. The
given taxes (including tariffs) need not be optimal, and hence this case is of fairly wide relevance. For this case Dasgupta and Stiglitz show that (assuming away the problems of other distortions apart from those introduced by the given fiscal system), if there are no fixed quotas, the shadow prices to be used for project evaluation in the public sector (and for private sector projects subject to government 'control') for tradeable goods are their 'border' prices, whilst for those for non-tradeables are their marginal foreign exchange costs that is "the value of the foreign exchange that would be earned if one less unit of the given non-tradeables were produced and the resources diverted to the production of tradeables." Whilst if there are quotas, then except for the goods subject to the quotas, for all other goods the same rules as given above apply; whilst for the goods subject to the fixed quota their "shadow prices" will be higher than 'international prices'. Hence as they conclude there is a general presumption for using 'international' prices in project evaluation.

148. It is not easy to provide a simple intuitive rationale for these results. However, they do suggest that of the two fully fledged project evaluation procedures currently on the market, the LM methods consistently suggest 'netting out' of taxes and the use of 'border' prices for tradeables and the marginal foreign exchange cost of non-tradeables as the relevant shadow prices of commodities. UNIDO on the other hand argues for the use of the "willingness to pay" criterion for measuring 'direct' costs and benefits would presumably include taxes in the derivation of the relevant shadow prices. Thus even though in principle the two procedures have been shown to be equivalent, in practice the results derived from following the
'rules of thumb' laid down on the alternative procedures could lead to different results. However, as the above second-best results suggest, in a large number of cases the LM rules are likely to give the 'more' correct shadow pricing rules than the UNIDO procedures.
References


