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**Guide to  
Practical  
Project Appraisal  
Social Benefit-  
Cost Analysis  
in Developing Countries**



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

PROJECT FORMULATION AND EVALUATION SERIES, No. 3

**GUIDE TO PRACTICAL  
PROJECT APPRAISAL  
SOCIAL BENEFIT-COST ANALYSIS  
IN DEVELOPING COUNTRIES**



UNITED NATIONS  
INDUSTRIAL DEVELOPMENT ORGANIZATION

Vienna, 1986

The views expressed in this publication are those of the author, John R. Hansen, a member of the staff of the World Bank, and do not necessarily reflect the views of the secretariat of the United Nations Industrial Development Organization (UNIDO) or of the World Bank.

ID/SER.H/3

**UNIDO PUBLICATION**

**Sales No. E.78.II.B.3**

Reprint of a publication originally issued  
under the *United Nations* imprint

**ISBN 92-1-106107-5**

**01400P**

## Preface

This book, written by John R. Hansen, a member of the staff of the World Bank, is a working guide based primarily on the United Nations publication *Guidelines for Project Evaluation*. The *Guidelines*, published in 1972, has become one of the major references in the literature on project evaluation, since it presents such a thorough discussion of the basic issues involved. However, its rigour and length have created a demand for a condensed and operational guide that would be useful to analysts in developing and industrialized countries. The present book has been designed to meet that need. It provides a succinct introduction to a difficult subject and thus makes the methodology of the *Guidelines* accessible to a wider number of readers. While still following very closely the approach of the *Guidelines*, it has sought to incorporate contributions from other sources such as the work of Ian M. D. Little and James A. Mirrlees.

This *Guide to Practical Project Appraisal*, despite its rather comprehensive title, does not pretend to cover all aspects of project appraisal in equal detail. Although it does establish a framework that brings together the most important aspects of project appraisal, its primary focus is on the economic and social benefit-cost analysis of projects. The reader is referred to basic references on the technical and financial appraisal of projects at appropriate points. Although risk analysis, which focuses on the probability of realizing certain rates of return, is an important tool of economic project analysis, it is equally applicable in financial analysis and has already been dealt with in great detail in numerous other publications. It will be dealt with here only briefly to demonstrate the way in which it may be combined with the stage-by-stage integrated graphical approach used in this *Guide*.

Although every effort has been made in this book to provide practical guidance, the reader will not find it a "cookbook". The problems of project analysis are far too diverse to allow a single, mechanical procedure. Economic and social conditions vary widely from country to country, and different problems arise in each sector. Also, the size of the project, recent experience with similar projects, the degree of uncertainty involved and the cost of carrying out the analysis will often determine the amount of appraisal work that is justified. Consequently, throughout this *Guide* it has been necessary to explore broad principles and offer only basic suggestions regarding application of the UNIDO method.

Although intended primarily for use on a national basis, the approach developed in this *Guide* would provide a framework within which countries in a common market could discuss the selection and allocation of regional industries, which, for reasons of economies of scale, should not be established in each of the member countries.

Three rather different types of readers may find this *Guide* of interest:

(a) The practitioner with little or no formal training in economics who is interested primarily in deriving an adequate measure of the economic and social benefits of a particular project;

(b) The analyst with some formal training in economics who would like to do more detailed socio-economic analysis;

(c) The economist who would like a relatively brief introduction to the UNIDO approach to economic project evaluation.

An attempt has, therefore, been made to write this *Guide* at three levels simultaneously.

The basic text is geared to the needs of analysts trained in economics and would be a useful text for such analysts participating in training workshops and seminars on project evaluation. Within the text, however, a number of simplifying assumptions have been given to assist practitioners who only want to make a basic estimate of the economic and social benefits of a project by the UNIDO method. These simplifying assumptions are flagged by the phrase "*in practice*". Also, the glossary of project evaluation terms will help such practitioners. For those who want more of the analytical flavour of the original text, a number of technical footnotes have been included. In general, however, this *Guide* is oriented much more to practitioners than was the original *Guidelines*.

The reader should note that neither this *Guide to Practical Project Appraisal* nor the *Guidelines* is intended for the appraisal of humanitarian assistance projects or for use by private profit-making units. In the former, the objective is not to maximize an economic or social rate of return, but rather to alleviate some specific human suffering. In the latter, consideration of national welfare is usually not considered a primary role; society, through its government, should establish prices and specific laws (e.g. occupational safety and anti-trust regulations) that will guide the private profit maker into making decisions consistent with national welfare. Finally, this *Guide* is concerned only with *ex ante* appraisal; the author leaves to others the discussion of *ex post* evaluation, the vital study of why a project succeeded or failed.

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#### EXPLANATORY NOTES

The term “rupees” (Rs) is used to designate domestic currency, regardless of the country. The term “dollars” (\$) is used as a general term for foreign currency.

In addition to the abbreviations found in the glossary, the following have been used in this report:

OECD Organization for Economic Co-operation and Development

USAID United States Agency for International Development

In tables, three dots ( . . . ) indicate that data are not applicable.

A dash ( – ) is equivalent to zero.



# I. BACKGROUND

## THE ORIGINAL GUIDELINES FOR PROJECT EVALUATION

The primary concern of the *Guidelines for Project Evaluation*,<sup>1</sup> upon which this book is based, was the lack of a satisfactory method of evaluating the economic and social benefits and costs of projects in developing countries. Such a method is important in countries where market prices have been distorted by heavy reliance on protective trade policies. It is equally important in countries where people are kept unemployed because minimum wage legislation and union pressure make the abundant labour too expensive and because subsidized interest rates, concessionary taxes on imported capital equipment and accelerated depreciation allowances make scarce capital too cheap. These policies also distort market prices, so that calculations of private profit do not reflect the profit or loss to the country as a whole.

Often market price distortions cannot be removed through basic economic policy changes because of powerful political forces with a vested interest in the *status quo*. Under such circumstances, one way of improving economic efficiency and social equity is to make investment decisions on the basis of "shadow" prices that reflect the true value to the country of its resources. These shadow prices may be "national parameters" (e.g. the shadow price for foreign exchange) or they may be specific to a given sector, region and/or project (e.g. the shadow wage rate for labour). The *Guidelines*, to put it in a nutshell, shows how such shadow prices may be calculated and applied in project selection.

The *Guidelines* is not concerned only with the efficiency of the use of resources, however, or with maximizing the growth of the gross national product; it is equally concerned with the inequities of income distribution that prevail in the developing countries. A major contribution of the *Guidelines* to the literature of economic project evaluation is its emphasis on investment decisions that enhance the equity of development.

Unfortunately, the most "efficient" development strategies often leave the present inequities of income distribution unchanged, and may even make them worse.<sup>2</sup> Efficiency and equity usually cannot be maximized simultaneously. There is a trade-off between them, and deciding where the balance lies is perhaps one of the hardest tasks facing development planners. To help the planners make these difficult decisions, the *Guidelines* stresses the aspect of investment decision making it calls the "bottom-up" procedure. Recognizing that the decision makers "at the top" generally find it difficult to offer any firm and quantitative rules about the relative importance of these two conflicting criteria to guide project analysts in their choice among alternative projects and project designs, the *Guidelines* suggests that project analysts prepare alternatives varying in the degree to which they maximize either efficiency or equity. Then, by observing which projects are chosen by the decision makers at the

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<sup>1</sup> United Nations publication, Sales No. 72.II.B.11.

<sup>2</sup> Hollis B. Chenery *et al.*, *Redistribution with Growth* (London, Oxford University Press, 1974).

top, the analysts can determine the implicit weights that are placed on these alternative objectives. This approach is, of course, not limited solely to efficiency *versus* equity, but may also be used to determine the weights decision makers place on other non-efficiency goals such as meeting “basic needs” of the poor or national self-sufficiency in energy resources.

Much has been made in the economic project evaluation literature of this “bottom-up” approach used in the *Guidelines*, but to label it as a strictly bottom-up methodology is wrong; the authors stress at the outset<sup>3</sup> that a two-way dialogue is always involved: interaction between the various levels—policy makers, central planning office, and project analysts—is never to be only “top-down” or “bottom-up”. Any rigid one-way structure would be irrelevant in small countries, especially those that are highly centralized, where the project analysts and decision makers may either be one and the same or may be individuals who work together closely on a regular basis. However, the concept of an iterative process of defining key parameters is relevant, even if only one person is involved. As analyst, the official prepares or has prepared a series of alternatives showing the impact of each from various points of view. Then, as decision maker, he looks at the implications of each and decides which is best, all things considered. This decision then reveals to him, through an analysis of the trade-offs he implicitly has made, the weights he intuitively assigned to various key objectives. These weights can then be refined in the course of preparing further projects.

Closely related to the equity-*versus*-efficiency decision that must be made in selecting projects is the decision on the extent to which today’s consumption should be sacrificed for investment that will yield even more consumption in the future. In short, how important are the needs of our children compared with our own? The UNIDO method forces planners to come to grips with this critical problem by asking the analyst to assign values to future consumption and present investment in terms of present consumption.

Two other features of the *Guidelines* set it apart. First, recognizing that some trade barriers will prevail indefinitely and that benefits must be maximized within this “suboptimal” environment, the *Guidelines* examines rather closely what consumers are willing to pay for goods in the domestic market. This perspective was one of the factors that led the authors of the *Guidelines* to choose domestic rather than foreign currency as their unit of account, or *numéraire*. If, however, there is any chance that additional demand for these goods will be supplied through trade, the *Guidelines* does encourage the use of border prices.

Secondly, in line with the emphasis of the UNIDO method on consumption as the ultimate reason for investment, the benefits and costs of projects are measured in terms of consumption instead of investment as in, for example, the Little-Mirrlees method.<sup>4</sup> This choice of *numéraire* does not, however, make any substantive difference in the conclusions reached by the alternative methods.<sup>5</sup> It should also be

<sup>3</sup> *Guidelines*, pp. 14-17

<sup>4</sup> I. M. D. Little and J. A. Mirrlees, *Project Appraisal and Planning for Developing Countries* (London, Heinemann, 1974). The original Little-Mirrlees method was published as *Manual of Industrial Project Analysis* (Paris, OECD, 1968)

<sup>5</sup> See pp. 27-32 for a discussion of *numéraires*. Basically, the choice of *numéraire* makes no difference to the conclusion for the same reason that it makes no difference if one uses kilometres or miles in determining the time required to travel between two points. The unit of account, the unit in which the distance is measured, is of minor importance provided that it is used consistently

added that, with the changes in the Little-Mirrlees method embodied in the revised (1974) edition and with the changes in the UNIDO method embodied in this *Guide to Practical Project Appraisal*, there is really very little difference between the methods in terms of their fundamental perspectives on economic project evaluation.

### Scope of the present book

As has been pointed out:

“... the elaboration of guidelines for project evaluation and formulation is not a one-shot, one-time affair that can stop after any given point; it is rather a continuing procedure where the written down methodology or set of principles must continually be updated, revised and informed by the practical experience of those whose job it is to put project evaluation into practice.”<sup>6</sup>

The *Guidelines* method of project appraisal has been broken down into the following five stages, each of which leads towards a measure of the social benefit of the project:

1. Calculation of financial profitability at market prices;
2. Shadow pricing of resources to obtain the net benefit at economic (efficiency) prices;
3. Adjustment for the project's impact on savings and investment;
4. Adjustment for the project's impact on income distribution;
5. Adjustment for the project's production or use of goods such as luxury consumer goods and basic needs whose social values are less than or greater than their economic values.

Each of these stages is based on modifications of integrated standard analytical tables. These tables, combined with graphical analysis, lead the analyst in logical stages from standard financial analysis to a complete economic evaluation of a project and its quantifiable social impacts.

Each stage is designed to shed light on the project's desirability from a different angle. No single stage of the UNIDO method can by itself provide sufficient information for judging the merit of a project, for each measures this merit from a different point of view—the impact of the project on the financial profits of the investor, on the utilization of the country's resources, on the savings and consumption pattern of the country, on the distribution of income, and on any other objectives the decision makers may wish to take into consideration. Similarly, a single value that might summarize all of these impacts by using some weighting scheme would be of little use, for such a value would cover up the project's impact on each of these areas.<sup>7</sup> The decision maker should be shown what each of these

<sup>6</sup> S. A. Marglin, Introductory presentation before the Symposium on Benefit-Cost Analysis held at the Inter-American Development Bank in Washington, D.C., in March 1973. H. Schwartz and R. Berney (eds.). *Social and Economic Dimension of Project Evaluation*. Washington: Inter-American Development Bank, 1977, p. 49.

<sup>7</sup> Lynn Squire and Herman van der Tak, *Economic Analysis of Projects* (Baltimore, John Hopkins, 1975), a recent and major contribution to the economic project appraisal literature, is an example of a method that implicitly subsumes all indicators into one final number through a scheme for weighting each “objective”.

impacts is expected to be. It is simplistic to think that two projects that come up with the same final "number" are necessarily equally desirable; that would assume universal agreement on the weights assigned to the different measures of the project's desirability, something that is never likely to be true in the real world. The dialogue between project analysts and decision makers will be much more fruitful if the analysis clearly identifies the various impacts a project has so that their importance may be discussed openly and directly.

#### *A sense of priorities*

Those who evaluate projects by benefit-cost criteria should evaluate their own work by the same criteria. It is easy to become so involved in the theoretical niceties of economic project appraisal that it is carried to the point where it produces only superfluous information instead of better investment decisions. However, a simple, uniform cut-off point for analytical detail cannot be established for all projects in all countries because needs vary too widely. Therefore, some of the details of the *Guidelines* analysis that are explained below will not be worth incorporating in the appraisal of some projects. These details must be mentioned to make them available if needed, but the analyst must decide which will be useful in evaluating a given project. *In practice*, the following points may be considered:

(a) A good technical and financial analysis must be done before a meaningful economic evaluation can be made. For this reason, stage one (financial profitability) is a prerequisite in all cases. Despite the volumes that have been written in recent years on economic project appraisal, good engineering analysis that presents well-considered alternatives is still probably the most important part of project preparation and is still far from common;<sup>8</sup>

(b) A commercial-profitability analysis would be sufficient, however, only if the project were to operate in a reasonably "perfect" market, that is, one in which prices reflected the relative scarcity values of various goods. If the market is "imperfect", as is generally true in developing countries, the economic-benefit analysis of stage two, where inputs and outputs are assigned their efficiency shadow prices, is required;<sup>9</sup>

(c) Stage three of the *Guidelines* analysis (adjustment for the investment/consumption impact) will be especially important for projects that generate benefits to groups who save very little out of additional income, especially in countries short of capital because of a gap between actual and needed savings;

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<sup>8</sup> *A Guide to Project Appraisal in Developing Countries* (London, Overseas Development Administration, 1972) provides very useful check-lists for technical, managerial and financial aspects of project appraisal. *Appraisal Guidelines for Development*, Part II (Washington, United States Agency for Industrial Development, 1974) is also very useful in this respect.

<sup>9</sup> The *Guidelines* tends to refer to shadow prices as "social" prices. However, to distinguish among the different shadow prices used in the various stages of this *Guide*, the terms "efficiency" and "economic" are used to denote shadow prices in stage two of the analysis, where the focus is only on economic efficiency. The term "social" is reserved for shadow prices in the analysis of stages three and four, where the impact of the project on income distribution is taken into consideration.

(d) The importance of stage four of the *Guidelines* analysis (income distribution) depends on the priority the government gives to increasing the income of the poor and on the degree to which the project generates more than average benefits to either the very rich or the very poor;

(e) Stage five will probably be needed only in unusual instances where the project will produce or use a good whose social value is substantially greater or lesser than its economic value.

*In practice*, because of the way in which the stages are laid out in this *Guide*, it is possible, and may even be desirable, to skip over certain stages if the adjustments required in that stage would be negligible. In an oil-rich country where savings are no problem but where income is very unevenly distributed, for example, it would be reasonable to skip stage three (impact on investment) and go on to stage four. Stage five may be especially important in socialist countries where non-efficiency goals are critical.

These five stages of analysis, combined with the technical and managerial analysis that must be part of the financial analysis, complete the conventional project appraisal. There is, however, an increasing awareness of the need to consider the "social soundness" of projects. Who will benefit from the project? Where do the beneficiaries live? Who will be hurt by the project? What are the minimum requirements in terms of education, for example, for participation in the project? Does leadership exist that can be mobilized to ensure the project's success? Or is a new organizational pattern needed to deliver the project's benefits to the target population? Many a project with a high economic rate of return has encountered serious problems because the analyst failed to ask such questions. Social-soundness analysis lies outside the scope of this book, though many of the questions raised by stage five can only be answered by a preliminary analysis of this type.<sup>10</sup>

### *Incremental analysis*

The approach used throughout this *Guide* assumes that the project to be analysed will constitute a new economic activity, a new factory or a farm on formerly unused land, for example. In practice, however, many projects will only modify an existing economic activity, e.g. a plant expansion or irrigation works on an existing farm. The existence of previous investments that would continue to yield benefits under the present project and that would therefore have to be taken into account would complicate the calculations, but none of the basic principles or methods would need to be changed to accommodate "incremental" situations. The only difference would be that three sets of data instead of one would have to be prepared. Instead of calculating only the future costs and benefits "with" the project, as is done for new projects, a second set of data reflecting the future situation "without" the project and a third set of data reflecting the "incremental" difference between the two would also have to be calculated.<sup>11</sup> *Incremental*

<sup>10</sup> Those interested in pursuing this matter further may wish to consult the section entitled "Guidance on social soundness analysis" in the *Project Assistance Handbook*, (Washington, United States Agency for International Development, 1975) pp. 5A-1 to 5A-12.

<sup>11</sup> It is important to note that this analysis must be "with and without", not "before and after". The situation without the project may improve (or deteriorate) even if the project is not implemented; the project cannot take credit only for changes occurring after its implementation that would not have occurred anyway.

cash-flow data must be used under such circumstances to calculate net present values and rates of return and thus determine whether the project will generate enough additional benefits to justify the additional cost. However, the analyst should also calculate the rate of return or net present value of the entire project (the "after" situation); situations exist in which, because of a rapidly deteriorating "without" situation, the incremental benefits are substantial, but the project is still not justified. Such might be the case, for example, in an area of marginal land that is eroding rapidly and should not be cultivated at all but instead be returned to forest land.

#### *Accuracy versus impact*

Economic project appraisal should determine whether a project is acceptable and, if it is, whether it is the best alternative; the purpose is not to quantify with great accuracy the myriad of direct and indirect effects it may have on the economy. Only those that may significantly affect the final conclusion should be considered. This may violate the theoretician's sense of propriety and perfection, but if a refinement in shadow prices is unlikely to affect the final conclusion, why bother? (A means of determining ahead of time which shadow prices would probably affect the final decision is discussed on page 15.)

This *Guide* also takes the view that rough shadow prices applied at the very outset of project design are far more important than perfect shadow prices applied just before the project is presented for final approval. The former shape the project according to economic priorities; the latter are merely cosmetic. As someone once said, what good does it do to give a shadow price to the labour of a tractor driver—it simply makes the capital-intensive farming technique more profitable! Shadow prices must be applied earlier, when the option of using draught animals for cultivation is still open. The same applies to other sectors, where, if the economist can inform the engineer of a major price distortion, the engineer will be able to design project alternatives from the outset that will be consistent with the real value of resources to the country.

Perfection in shadow prices is obviously pointless if they are to be applied in the very early stages of project design, when even the basic information on physical inputs and outputs is very rough. Exceptional accuracy in the shadow prices would quickly be lost on such rough data, yet it is precisely these data to which the shadow prices must be applied if they are to have their greatest impact. The economist can, however, still play a useful role in the latter stages of project preparation by working with the engineer and financial analyst to refine the project design so as to maximize both its financial and economic profitability.

The literature of project appraisal commonly gives the impression that the goal is to produce a number or set of numbers that tells whether a project is good or bad. In reality, it is not the numbers themselves that are important, but rather the appreciation of the project's relative strengths and weaknesses that is gained in the course of appraising it. The numbers are simply an instrument of discipline that forces the analyst to examine all relevant factors and a means of communicating his conclusions to others. The judgement of a seasoned analyst who is sensitive to the major differences between the market and the economic values of important inputs and outputs may result in a much more accurate measure of the worth of a project

than a fancy mathematical method applied by an inexperienced analyst. Almost all quantitative approaches, and the present one is no exception, contain elements that make the results highly sensitive to certain critical assumptions.<sup>1 2</sup> It is, therefore, essential to season the quantitative aspects of appraisal with a large measure of common sense.

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<sup>1 2</sup> See pp. 72-73 for an example of the impact that assumptions about income-distribution weights can have on the rate of return.

## II. STAGE ONE: FINANCIAL PROFITABILITY AND THE ANALYTICAL FRAMEWORK

Stage one—financial profitability—produces an estimate of the project's financial profit or, in the language of the *Guidelines*, the net present value of the project when all inputs and outputs are measured at market prices. Very little will be said here about the basic problems of financial analysis such as costing, market studies and financing.<sup>13</sup> This chapter will, however, discuss in some detail an analytical framework that has been developed to make it easy for the analyst to move consistently through the various stages of the UNIDO analysis. The main components of this framework are:

(a) Standard tables based on an integrated documentation system that serves as the foundation for all calculations in this *Guide*;

(b) A graph that allows direct estimation and sensitivity tests on net present values and internal rates of return.

This analytical structure becomes increasingly important in the later stages of analysis, but the components must be used properly from the outset to enjoy their full benefit.

### Integrated documentation system

#### *General*

Most articles and books on project evaluation suffer from a mundane but important shortcoming: there is no standardized format for recording and manipulating the data. Since the *Guidelines* was no exception, this *Guide* develops a set of standard analytical tables as the basis for calculating a project's net benefit in each stage of the UNIDO method. Three basic tables—the financial income statement, the cash-flow statement and the balance sheet—combined with a few shorter tables used to make adjustments for economic and social values, are the basis for financial, economic and social project appraisal in this *Guide*. With these, the analyst can easily check the consistency of his work, and policy makers can identify the important discrepancies between market and economic prices. The integrated documentation system<sup>14</sup> upon which these standardized tables are based makes them even more useful and informative, for it permits direct numerical reference from the three concise summary financial tables to supporting documentation. A set

<sup>13</sup> These subjects are already well covered in standard corporate finance books such as James C. van Horne, *Financial Management and Policy*, 4. ed. (Englewood Cliffs, New Jersey, Prentice Hall, 1977), or A. J. Merrett and Allen Sykes, *The Finance and Analysis of Capital Projects*, 2. ed. (New York, Halsted Press, 1973).

<sup>14</sup> This term, to the best of my knowledge, was first used by John P. Powelson, who developed this concept while evaluating project appraisal procedures at the Inter-American Development Bank. See "An Integrated Documentation System for Development Banks", *International Development*, 1968 (Dobbs Ferry, New York, Oceana, 1969), pp. 321-324.



of sample standard tables (tables 1-3) and supporting tables (tables 4-7) demonstrate the basic principles of the integrated documentation system. (All tables will be found in annex I.) Although the data are hypothetical and have been limited to three years to clarify the presentation, standard accounting practices have been followed, aside from a few differences in format to accommodate the needs of the approach outlined in this *Guide*. Because such practices are discussed in a wide variety of financial textbooks,<sup>15</sup> the numbers included in these sample tables are not examined in detail. The economist or engineer who is unfamiliar with accounting procedures may find it worth while, however, to trace the flows through the tables from year to year.

The most obvious deviations from the format of standard financial tables are the following: first, the income and cash-flow statements include three columns for the present values at three discount rates. These values serve as the basis for the transition from financial to economic analysis and are explained in more detail later in this chapter. Secondly, the cash-flow statement is divided into two main parts, one dealing with operating cash flows related to sales or purchase of physical items, and the other dealing with money flows involved in financing operations (e.g. sale of equity stock and borrowings). The cash flows related to "real"<sup>16</sup> transactions are all that are necessary for economic-efficiency analysis; however, purely financial transactions can involve "distortions" such as income taxes that have an impact on the distribution of income even though they do not entail the purchase or sale of real economic assets.<sup>17</sup>

This approach logically involves a related deviation from standard financial tables; working capital is divided into physical (inventories) and financial (cash and receivables). Consequently, instead of including all working capital investments as economic costs in the first formulation of the cash flow, then placing a zero value on the strictly financial components as is usually done in economic analysis, the latter are excluded from the economic calculations from the outset.

The standard financial tables that form the mechanical basis of the methodology of this *Guide* are obviously most applicable and easiest to use for projects in sectors such as industry and agriculture where there is a marketed output and production units keep conventional financial accounts. Nevertheless, with a little ingenuity, these tables can be used for projects in almost any other sector as well. One of two approaches is possible. First, if, for example, there is a reasonable way of quantifying the value of the output by imputing a value to each hospital bed or each school place constructed and operated on the basis of what it costs to stay in a hospital or run a school, which is some reflection of what society is willing to pay, at least some notional form of "revenue" can be entered in the income statement. (The cost side generally creates no problem; both investment and operating costs, even for the most non-marketable of services, are tangible and easily put in money terms.) Secondly, if there is no reasonable way of imputing a value to the output, the revenue part of the income statement can be left blank, and only the cost side and the cash-flow statement filled in. The cash flow in this event will, of course, be negative, but it will

<sup>15</sup> e.g. Van Horne, *op. cit.*

<sup>16</sup> "Real" includes not only materials, equipment, labour etc., but also intellectual properties (e.g. patents) and other similar intangible real resources; however, it excludes money and other financial instruments.

<sup>17</sup> In the case of borrowed capital, it is already valued from an economic point of view at its opportunity cost through the discounted cash-flow method; the approach used here makes it possible to consider in addition the fact that the interest subsidy means a transfer of income from lender to borrower.

still be possible to make the appropriate adjustments in the valuation of the costs at each stage and to come up with a reasonable economic least-cost analysis.

#### *Technical details*

As noted above, the starting point for the integrated documentation system is a set of standard financial tables that should be familiar to financial analysts, engineers and economists alike. No universal format exists for such tables; they are always tailored to the specific firm or project. An attempt has been made here, however, to present tables that are conventional in format and that cover the major categories of costs and benefits comprehensively. When there was reason to believe that entries might be required that would not logically fall under one of the *pro forma* categories listed, an "other" section was included. If the analyst wishes, he can spell out the details of any "other" category in a supporting table. *In practice*, all items in the summary tables should have supporting documentation giving breakdowns of totals and the assumptions used in developing these totals.

In choosing the categories to be listed in standard analytical tables, the analyst should limit the number so that the tables can serve as a summary that can be reviewed quickly to obtain an overall picture of the financial structure of the project. At the same time, however, to facilitate working with the net present values that will be the basis for shadow pricing and other adjustments in subsequent stages, the summary financial income statement (table 1) should, to the extent feasible, contain lines for each of the inputs and outputs that will have to be adjusted separately (e.g. skilled and unskilled labour should both appear, since, in most cases, their shadow prices, and thus the adjustment factors used to move from the financial to the economic value of wages, will be different). Likewise, if there is more than one output and the adjustment factor for each is different, each should appear on the summary statement. Items with a common adjustment factor should be grouped together to simplify calculations.

Since the summary tables usually will not provide sufficient information and detail for those actually working with the project, a numbering system has been introduced to allow more detailed ancillary tables to be integrated into the documentation. A modified decimal code permits any desired number of subdivisions at any level through the means of a very simple punctuation system. Take, for example, the section "sales at factor cost" in table 1 (FIS 1.0-18.0). It is found on the third line and is designated "3". The first major subcategory of sales at factor cost, which is "light tractors", appears in a back-up document (table 4—FIS 3.0-3.2) and is designated "3.1", while the second major subcategory is "heavy tractors", designated "3.2". The former, for example, is then broken down further into value (3.1.1/), quantity (3.1.2/) and so forth.

If additional information is required to document the data on quantity of light tractors in the northern market, for example, it can be entered in a separate table numbered FIS 3.1.2/1 (table 5). The numbering system thus makes it very easy to trace summary data back to the tables showing the detailed assumptions behind them. The same figure should appear in both the detailed table and in the summary table so that there is no need for intermediate calculations to link the two. (For example, the total sales of tractors at factor cost of 10,125 in year 1 as shown in table 4 (line 3.) also appears in line 3. of table 1.)

The integrated documentation system is fully compatible with all standard methods of economic project evaluation. In fact, if the same shadow prices are used

in each of these methods, the same tables with very minor modifications can be used to generate indicators such as the rate of effective protection, the Bruno ratio, net present value and the internal economic return. (The last two are discussed below.) Also, while this system could be adapted to computerization without difficulty, a graphical method has been developed for this *Guide* that makes the system far easier to use than conventional methods of calculating net present values, internal rates of return and shadow prices and of doing sensitivity analysis, even if only a pocket calculator or a slide rule is available.

## **Financial analysis**

### *Income statement*

The first step in stage one is to complete standard income, balance-sheet and cash-flow tables like those shown in annex I. The financial income statement (FIS) is the central table in this analysis, for it is used to record the inputs and outputs of the project (see table 1). The values entered in the table at this stage of the analysis are at market prices. In stage two, the present values from this table will be adjusted to produce a net present value that reflects economic-efficiency prices and the premium on foreign exchange. These same present values will be used in stages three and four to analyse the project's impact on savings and on the distribution of income.

### *Current or constant prices*

In preparing not only the financial income statement but the cash-flow and balance sheets as well, a choice must be made between current and constant prices. Forecasts in current prices, which include the effects of inflation, are necessary to give a correct picture of the actual financial position of a project in any given year with respect to the costs of inputs and outputs and thus to its cash-flow position. However, such forecasts do not give a realistic picture of the true financial profitability of a project. Inflation can artificially improve apparent profitability by increasing future revenues as compared with today's capital costs. In other words, today's capital costs are repaid with cheaper or less valuable future dollars. A project relying on current-price accounting would, however, ultimately find its depreciation allowances inadequate to replace capital equipment at the prices prevailing when they need replacement. To avoid this, assets must be revalued in line with inflation. Alternatively, as is done in this *Guide*, future net revenues may be stated in constant prices or values based on today's investment price levels.<sup>1 8</sup>

<sup>1 8</sup> If sufficient information is available to forecast differential rates of inflation, adjustments in real relative prices will be necessary. They are made most easily by removing an appropriately weighted average index of inflation such as the wholesale price index from the individual rates, thus netting out the inflationary trend, leaving only relative upward and downward price movements. For example, if three inputs are involved and their prices are forecast to rise at 4 per cent, 6 per cent and 8 per cent, respectively, while the annual average rate of inflation is forecast at 5 per cent, dividing each rate plus unity (1.04, 1.06, and 1.08) by 5 per cent plus unity (1.05) then subtracting unity from the result gives relative price movements of -1 per cent, 1 per cent and 3 per cent, rounded to the nearest whole per cent. (If the differences in rates of inflation are minor, results that are approximately correct may be obtained by subtracting the average rate from each specific rate.) These factors should then be applied to the present annual values to obtain the future "constant" prices appropriately adjusted for changes in relative real values.

### *Cash flow and balance sheet*

Because both financial analysis and economic analysis in the UNIDO method are based on discounted cash-flow values, the financial income statement, which shows only annual profits and disguises investments, is not as convenient a basis for doing the actual discounting calculations as is the financial cash-flow (FCF) table (table 2). The net cash flow is derived from the financial income statement by standard accounting procedures and is equal to the gross cash flow (operating profit before interest and taxes plus allowances for depreciation) minus capital investments. For the shadow pricing of capital investments, which is done in stage two, it is convenient to have one more table, the financial balance sheet (FBS), which breaks capital costs down into various categories (table 3). The additional tables that feed into this table through the integrated documentation system can be used to disaggregate these costs into imported and domestic materials, labour, and other costs, to the extent necessary for shadow pricing in stage two.

### *Disaggregated value discounting*

Once the financial tables have been prepared, the financial acceptability of the project must be tested through discounted cash-flow analysis.<sup>19</sup> The conventional way of doing this is to discount to the present the net cash flow in each year (the flow shown in line 1 of table 2, for example) and then express the result either as a net present value or, once the discount rate that yields a zero net present value has been found, as an internal rate of return. The project is, of course, commercially acceptable:

- (a) If the project has a non-negative net present value at the investor's opportunity cost of capital;
- (b) If the internal financial rate of return is acceptable.<sup>20</sup>

If the project is not commercially viable but does have a positive net economic value as calculated in the following steps, economic policy changes regarding subsidies, market prices (if price controls are imposed), taxes and/or tariffs will be required to make the project commercially viable as well. Conversely, if it is commercially viable but economically unacceptable, the project must be rejected, or redesigned if possible.

Because shadow pricing in subsequent stages of this *Guide* is based on adjustments of the discounted present value of individual inputs and outputs rather than on their annual values, a somewhat unconventional approach is required that involves discounting to the present each item or group of items with a common relationship of shadow to market price rather than discounting the net annual cash flow as a whole. In practice, however, this disaggregated present-value approach to shadow pricing has some major advantages.

First, provided that the relationship between market and shadow price is constant over time (or that a suitable average relationship over time can be estimated), the need to give a shadow price to individual annual values of an input or

<sup>19</sup> See p. 29 for a discussion of the need for discounting.

<sup>20</sup> If risk is considered, the probability of obtaining an adequate rate of return or a positive net present value must also be taken into account.

output is eliminated; it is necessary only to give a shadow price to its single present value.<sup>21</sup> (For any major input or output with a variable relationship between market and shadow price over time, the annual values for this one item can be adjusted and discounted back to the present to obtain the appropriate present value.) Secondly, since annual values are not involved, it is not necessary to repeat the discounting process every time a shadow price is changed. Thirdly, sensitivity analysis becomes very easy as a result; the present value is simply adjusted up or down as required. Fourthly, as will be shown below, the present values quickly indicate to the analyst the inputs and outputs for which accuracy in shadow prices is important. *In practice*, there is no sense in seeking perfection in a shadow price that will have no significant impact on the net present value of the project.

These advantages, however, have associated costs, if conventional arithmetic discounting methods are used.

First, since the annual values of individual inputs and outputs rather than net annual cash flows are discounted to the present, the number of discounting operations could quickly become unmanageable without a computer. Sensitivity analysis with various discount rates would make the problem even worse, for each input and output value would have to be discounted separately over the life of the project at each rate. If, for example, the financial opportunity cost of capital were 8 per cent and the social discount rate 15 per cent, and if the analyst wanted to test for net present values at discount rates plus or minus 20 per cent of these estimates, using the conventional mathematical approach, it would be necessary to discount each of the items, which might easily number 15-20, by six rates (6 per cent, 8 per cent, 10 per cent, 12 per cent, 15 per cent and 18 per cent, rounding to integer values). For a 30-year project, over 7,000 numbers would have to be entered in the calculator, a thankless task at best.

Secondly, since annual values have not been adjusted for shadow prices, an internal rate of return cannot be calculated using conventional methods, and for better or worse, many people prefer the internal rate of return to the net present value because it gives a percentage rate of return that looks like the familiar profit rate.<sup>22</sup>

Thirdly, with the net-present-value approach, which is theoretically preferable and is used in the *Guidelines*, the discount rate must be specified in advance, but it is generally not known with any certainty. Consequently, the *Guidelines* recommends that several discount rates be applied to test the sensitivity of the project, which, as indicated above, creates inordinate problems in calculating when the conventional mathematical approach is used.

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<sup>21</sup> In the conventional year-by-year approach, the cost of labour, for example, is multiplied by the conversion factor; then the result for each year is multiplied by the discount factor corresponding to the discount rate, and the discounted values for all years are added up. With the approach recommended here, the order is changed slightly, but since  $3 \times 4$  is the same as  $4 \times 3$ , it makes no difference. In the present-value adjustment method proposed here, the financial cost of labour in each year, for example, is multiplied by the discount factor; the discounted values are added up; and then the net present financial value is multiplied by the conversion factor. This is demonstrated in mathematical terms in annex II.

<sup>22</sup> Great caution is required here. The normally observed financial percentage rate of profit is very different from the economic internal rate of return, and the two should not be compared, much less confused, for (a) the former is usually a one-year concept, while the latter is based on the discounted cash-flow analysis over the life of the project; (b) the former is in market prices, while the latter is in economic prices; and (c) the former is usually based on fixed assets excluding working capital, while the latter covers all resources employed.

### Graphical discounting

Problems in calculating are not insuperable, however. A very simple graphical method may be used to avoid them, a method based on the fact that when a project's net present values at different discount rates are plotted on standard arithmetic grid paper, the result will be similar to figure I. This figure is based on the financial and economic cash flow of the hypothetical project shown in tables 8 and 9. In table 8 the net present value of the financial cash flows corresponding to discount rates of 0 per cent, 10 per cent and 20 per cent can be read at the bottom (2,000, 246 and -371). These values, plotted against the corresponding discount rates, give the financial curve in figure I. The economic curve is similarly derived from the values 1,000, -169 and -581, which appear at the bottom of table 9.

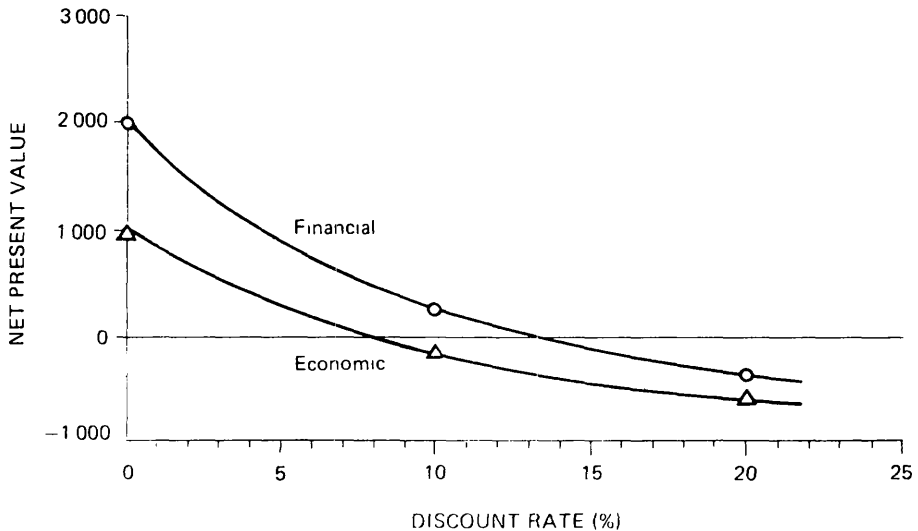


Figure I. Net-present-value curves

This graphical approach has several immediate advantages.

First, it eliminates most of the calculations mentioned above that arise when (a) the economic and financial discount rates are different; and (b) sensitivity analysis is required. For example, figure I shows that, at a financial opportunity cost of capital of 8 per cent, the financial net present value is positive; also, a sensitivity test of  $\pm 25$  per cent (i.e. at 6 per cent and 10 per cent) shows that the net present value is still positive.<sup>23</sup> Likewise, at an economic discount rate of 15 per cent, the economic net present value is negative, and it stays negative within a  $\pm 20$  per cent range (i.e. 12-18 per cent). The project would be economically acceptable only if the economic discount rate were as low as 7.7 per cent. All this information, it should be noted, is available even though only two non-zero discount rates (10 per cent and

<sup>23</sup> The actual net present value could be read fairly easily from the graph at these discount rates (e.g. about 725 at 6 per cent), but if the discount rate has been chosen correctly, the size of the net present value is generally unimportant, any project with a zero or positive net present value is acceptable unless, of course, mutually exclusive project alternatives are being appraised

20 per cent) are applied.<sup>24</sup> The reasons for choosing 10 per cent and 20 per cent are given below; suffice it to say here that these values are essentially independent of the actual financial and economic discount-rate values in any particular situation.

Secondly, the graphical approach recommended here permits calculation of internal rates of return in both financial and economic terms, even though the individual annual values have not been adjusted. The internal rate of return is simply read off the horizontal (discount-rate) axis at the point of which the axis is cut by the relevant curve; the internal rate of return is, by definition, the point at which the net present value is zero. In figure I, the internal financial rate of return is 13 per cent, while the internal economic return is about 7.7 per cent.

A third advantage of this approach is that it allows the analyst to obtain a rough idea of the shadow prices that are worth spending time on and those that can just as well be estimated crudely. In theory, shadow prices should be calculated precisely, and no project should be accepted whose rate of return is not at least equal to the cut-off discount rate. In practice, however, the range of uncertainty about all variables is usually such that a difference of at least 2 per cent in the rate of return is required to be significant, and even this may not be conclusive. A project with a 10 per cent rate of return may well be accepted even with an estimated 12 per cent cut-off point on the basis of uncertainty. From a graph like figure I, the analyst can quickly estimate the change in net present value that would produce a 2 per cent change in the rate of return. Knowing the amount of change in present value required to cause a significant variation in the internal rate of return and the net present value of each input or output, the analyst can easily calculate the percentage change in any given shadow price required to make a real difference. For example, using the financial curve, a reduction in the net present value of about 200 is required to reduce the financial rate of return from 12 per cent to 10 per cent. The accuracy of this estimate will, of course, be affected by the rate of discount, the slope of the curve, the relationship between the financial and economic curves, and the pattern over time of the values under consideration. If, however, labour consisted of only 200 out of the 830 net present value of costs at 10 per cent listed in table 9 for this project, for example, a 100 per cent change in the shadow price of labour would be required to change the internal rate of return by about 2 per cent. Under such circumstances, an inaccuracy of even 50 per cent in the shadow wage rate is hardly worth worrying about.

The basis for the financial present-value curve is the set of financial tables discussed above. A simplified version of the financial cash-flow statement (table 2) was given for a less complex project in table 8 (financial discounted cash flow) to make the discussion easier. The hypothetical project involved an investment of 1,000 in year 0 and net benefits of 1,000 in years 5, 10 and 15.<sup>25</sup> Profits, defined to include depreciation, interest, taxes etc. so that they represent cash flow, are equal to the difference between sales and costs in each year. The operating profit (cash flow) minus the capital outflow (investment) in each year equals the net cash flow shown in the bottom line. This row alone would be sufficient for calculating net present value or rate of return; but to facilitate subsequent shadow pricing, which will affect

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<sup>24</sup> A third discount rate of 0 per cent is implicitly required, because the undiscounted values in each year must be added up to obtain the net present value at a zero discount rate.

<sup>25</sup> This strange pattern of net benefits was chosen simply to minimize the number of figures and yet, at the same time, obtain a range of present values using reasonable discount rates that was wide enough to plot clearly.

the various components of this net figure differently, the individual streams in the previous four rows are maintained and each is discounted at 0 per cent, 10 per cent and 20 per cent to establish the plotting points.<sup>26</sup>

The discounting of individual streams back to the present can be simplified in several ways. The biggest simplification is, of course, the introduction of the graphical method, which even makes it possible to do discount-rate sensitivity analysis and to calculate internal rates of return using only two non-zero discount rates. The number of calculations can be reduced further by isolating the input and output values that will require shadow pricing from those that will not. Those that will not, whose economic and financial values are the same, can in effect be ignored. As long as they have been included in the totals that go into calculating the annual financial cash flows, which are discounted to the present, there is no need to deal with them separately.<sup>27</sup> Items that will require adjustment from financial to economic prices should be grouped together within categories (e.g. various kinds of equipment) to the extent they have the same percentage adjustment (adjustment factor) so that they can be discounted simultaneously.<sup>28</sup>

Since only two discount rates are normally required, it becomes entirely practical to put a 30-year list of discount factors for 10 per cent and 20 per cent on a small card that can be left in the case of a pocket calculator for use in the field; there is no need to carry along a bulky set of financial tables. Furthermore, this graphical method is so robust that internal rates of return accurate to within about 2 per cent can be calculated on a simple blank grid on the back of the card using the procedure described above (see figure II).

The discount rates of 0 per cent, 10 per cent and 20 per cent are chosen strictly for technical reasons and have no financial significance. Zero per cent is always the first test to apply before discounting. It is very easy, since it only requires adding up the annual figures as they appear. Also, if a project does not have a positive net present value at a zero discount rate, there is no point in going on with the

<sup>26</sup>The figures in the 13 per cent discount-rate column are extra; the only purpose is to demonstrate that the 13 per cent internal rate of return, which can be read off the graph as explained above, does in fact yield a zero net present value.

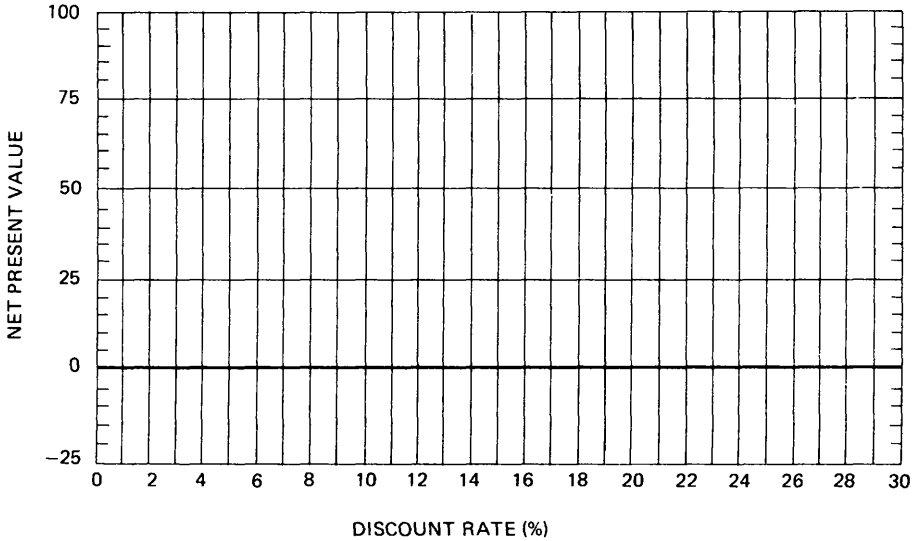
<sup>27</sup>This is the major advantage of the adjustment-factor approach used in this *Guide* as compared with the conversion-factor approach used in the Little-Mirrlees method (see p. 32).

<sup>28</sup>If values for certain costs and benefits are assumed to remain constant after the project has reached full development, a common assumption, values in the remaining years can easily be discounted to the present by a single "present-value-of-an-annuity" (PVA) factor rather than applying a discount factor to each year. This PVA factor indicates how much a dollar received or paid annually for a certain number of years is worth today at a given discount rate. Assume, for example, that the project will yield a benefit of \$100 per year from year 5 to year 30 and that the discount rate is 10 per cent. The PVA factor for all 30 years cannot be used, for the full \$100 is not received during the first four years; but this problem can be avoided by subtracting the PVA factor for the first four years from the PVA factor for the full 30 years, thus leaving the PVA for the remaining 26 years. Any standard financial tables will indicate that at 10 per cent the PVA factors for the years 4 and 30 are 3.170 and 9.427, respectively. Subtracting gives a PVA factor for years 5-30 of 6.257, which, when multiplied by the \$100 of annual benefits over these years, gives \$625.70, the net present value of this stream. This plus the annually calculated net present values of the benefits from years 1-4 gives the total NPV of the benefits. This is then repeated at a 20 per cent discount rate to obtain the other plotting point. A 30-year list of the PVA factors at 10 and 20 per cent is presented in figure II. The approach, of course, assumes that the discount rate will remain constant over the period to which the approach is applied. If, for example, the rate is 10 per cent from years 5-20 and 15 per cent from years 21-35, the values for the latter period should be calculated as of year 20 at 15 per cent, then discounted to the present at 10 per cent.



discounting analysis on that design of project. A negative net present value at a zero discount rate is evidence that the analyst should work with his engineering and financial colleagues to find a more appropriate project design.

GRAPHICAL DISCOUNTING



Values in year zero

Year	Discount factor		Present value of annuity		Year	Discount factor		Present value of annuity	
	10%	20%	10%	20%		10%	20%		
1	0.909	0.833	0.909	0.833	16	0.218	0.054	7.824	4.730
2	0.826	0.694	1.736	1.528	17	0.198	0.045	8.022	4.775
3	0.751	0.579	2.487	2.106	18	0.180	0.038	8.201	4.812
4	0.683	0.482	3.170	2.589	19	0.164	0.031	8.365	4.843
5	0.621	0.402	3.791	2.991	20	0.149	0.026	8.514	4.870
6	0.564	0.335	4.355	3.326	21	0.135	0.022	8.649	4.891
7	0.513	0.279	4.868	3.605	22	0.123	0.018	8.772	4.909
8	0.467	0.233	5.335	3.837	23	0.112	0.015	8.883	4.925
9	0.424	0.194	5.759	4.031	24	0.102	0.013	8.985	4.937
10	0.386	0.162	6.145	4.192	25	0.092	0.010	9.077	4.948
11	0.350	0.135	6.495	4.327	26	0.084	0.009	9.161	4.956
12	0.319	0.112	6.814	4.439	27	0.076	0.007	9.237	4.964
13	0.290	0.093	7.103	4.533	28	0.069	0.006	9.307	4.970
14	0.263	0.078	7.367	4.611	29	0.063	0.005	9.370	4.975
15	0.239	0.065	7.606	4.675	30	0.057	0.004	9.427	4.979

Figure II. Field card for calculating internal rate of return and net present value

Three copies of the card presented here have been placed at the back of this Guide, and should be cut out along the dotted line, photocopied if needed and pasted on the front and back of a standard-sized index card. It provides:

- (a) Basic factors at 10 per cent and 20 per cent for discounting;
- (i) Different values in individual years (discount factor);
  - (ii) A flow of equal values over several years (PVA);
- (b) A graph for recording the resulting net present values at 0 per cent, 10 per cent and 20 per cent rates of discount.

The point at which the curve connecting these three plotting points cuts the horizontal axis indicates the internal rate of return. (The durability of this chart can be improved by spraying it with clear plastic.)

The 20 per cent discount rate is chosen to get a plotting point well above the best estimate of the cut-off discount rate; 25 per cent would have been just as good. This procedure ensures that either the net present value shall be positive at a discount rate unquestionably higher than the cut-off discount rate or that the net present value shall be negative at this discount rate. It is important to have a negative net present value for the graphical procedure (unless the rate of return is well above the cut-off rate) because this provides plotting points both above and below the horizontal axis in the critical range, making it much easier to plot accurately the point at which the curve cuts the discount-rate axis, the point that determines the internal rate of return. The 10 per cent rate of discount was chosen simply as a midpoint between 0 per cent and 20 per cent. A midpoint is important, for present-value curves plotted on normal graph paper will almost always bow down in the middle; they are not straight lines, and the 10 per cent plotting point establishes the degree of curvature.<sup>29</sup> As a practical matter, however, the analysis in stages three and four can be simplified slightly if the midpoint chosen is also the best estimate of the consumption rate of interest.

### Link to economic analysis

This chapter has laid heavy stress on the details of the financial analysis because once the financial net-present-value data have been set up as in table 1, it is very easy

<sup>29</sup> The points should not be connected with straight-line segments; the smooth curve is important for determining accurately the internal rate of return, which can be read to a fraction of a per cent if the graph is done carefully, and on sufficient scale. A smooth curve is much easier to draw with a draftsman's flexible curve than by hand. However, if the three plotting points indicate only a minimal curvature and if one of the points lies fairly close to the horizontal axis, a straight line between the two points nearest the axis, if reduced by about 1 per cent, will give a very close estimate.

The internal rate of return can also be estimated by interpolation based on the present values used as plotting points. For example, the present values for the hypothetical project in this book at 0 per cent, 10 per cent and 20 per cent are 4,125, 301 and -2,371 (see table 11 line 1). The internal rate of return obviously lies between 10 per cent and 20 per cent, for the present value turns from positive to negative in that range. The more or less exact point may be found by interpolation as follows: (a) determine the difference between the positive and negative present values by subtracting the latter from the former ( $301 - (-2,371) = 2,672$ ); (b) calculate the difference between the positive value and zero as a fraction of the difference between the present values at 10 per cent and 20 per cent ( $301 - 0 = 301$ ,  $301/2,672 = 0.1126$ ); (c) multiply the difference between the two discount rates (20 per cent - 10 per cent = 10 per cent) by this factor to obtain the number of percentage units that should be added to the lower value ( $0.1126 \times 10 \text{ per cent} = 1.1 \text{ per cent}$ ); (d) add the number just calculated to the base value to obtain the internal rate of return (10 per cent + 1.1 per cent  $\approx$  11 per cent). This estimate can be verified by consulting figure IV.

to move on to economic analysis. This analysis will be discussed in more detail in the following chapter, but table 9 gives a hint of how it is done. In that table, it is assumed that the only difference between economic and financial values, aside from the discount rate, is that the economic value of the output is 20 per cent less its market value. Thus, once the present values in financial terms have been recorded from table 8, an economic adjustment factor (AF) of -20 per cent is applied to the net present values of sales at each discount rate, and the results are recorded in the appropriate columns under economic adjustment. (Note that since "profit" is a residual item, the difference between sales and costs, a separate AF is not required.) The net adjustments are then summed up, and the economic cash flow at each discount rate is determined by applying the net adjustments to the respective net present values of the net financial cash flows. The resulting values (1,000, -169 and -581) are plotted on figure I to produce the economic curve, which shows an internal economic rate of 7.7 per cent.

### III. STAGE TWO: DIRECT ECONOMIC BENEFITS— GENERAL ISSUES AND PRINCIPLES

Stage two of this *Guide* produces an estimate of the net present value of the project measured at efficiency shadow prices instead of market prices. Before dealing with efficiency shadow prices *per se*, however, which are handled in the following chapter, it would be helpful to discuss first some of the general principles of economic project appraisal. The first part of the chapter examines the critical issues of second-best optimization and the extent to which shadow pricing should be selective. The remainder of the chapter goes into the general principles of shadow pricing and some more specific questions about taxes, *numéraires* and adjustment factors.

#### Second-best optimization

Does shadow pricing do any good, is it even logical, if the government is not willing to be “sensible” in its economic policies? Is it reasonable to expect a government to be “rational” in selecting projects when it is “irrational” in setting macro policies that create “distorted” market prices? While these are valid questions, it is assumed in this *Guide* that governments find it possible to take actions at the micro level that are not possible at the macro level because of political and administrative constraints. Although conceptually untidy, there is considerable empirical evidence that governments can do good by stealth through decisions on individual projects even when at the same time they find it impossible, for example, to “get the prices right” by removing tariff protection on imported goods, which would give domestic manufacturers market-price signals consistent with economically efficient use of the country’s resources.

This question may be carried further to ask whether we can be sure that we are even moving in the right direction by a piecemeal attack on distorted prices. There is always a theoretical danger in any approach that uses a somewhat *ad hoc* mixture of market prices and shadow prices (the latter being introduced only when the former are clearly distorted) that, since these are not “general-equilibrium” prices that have been obtained from a complete, idealized model of the economy, we may actually end up making things worse. The problems of second-best optimization cannot be pursued further here,<sup>30</sup> but *in practice* it can be assumed that the types of

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<sup>30</sup> For an excellent introduction to these problems, see I. M. D. Little and J. A. Mirrlees “The economics of the second-best”, chapter 19 in *Project Appraisal and Planning for Developing Countries* (London, Heinemann, 1974). For a more general and technical discussion, see R. G. Lipsey and K. Lancaster “The general theory of second-best”, *Review of Economic Studies*, vol. 24, No. 1 (1956), pp. 11-32.

information provided in the different stages of this *Guide* will lead to a better allocation of resources than would have resulted from the use of clearly distorted market prices.<sup>31</sup>

### Selective shadow pricing

Theoretically, as implied above, all shadow prices should be derived from a comprehensive mathematical model of the economy. *In practice*, however, shadow pricing should be done selectively in terms of two criteria. First, which resources figure most prominently in the benefits and costs of the project at market prices? Secondly, for all resources involved in the project, which market prices are farthest out of line with their respective shadow prices? These criteria concentrate scarce analytical resources on the most important divergencies between market and economic profitability. However, a major caveat is in order: both of these criteria must be applied simultaneously. If attention were focused solely on those resources that were most prominent at market prices, an economically undesirable project that depended heavily for its financial success on, say, grossly underpriced electric power could be accepted because the power would appear as a very minor item in the market-price analysis. *In practice*, the most obvious candidates for shadow pricing will be:

(a) Main outputs. (They constitute virtually the entire benefit stream if there are no externalities and are often sold at protected prices);

(b) Importable material inputs. (If domestically produced, they may enjoy substantial protection; if imported, they may be heavily taxed);

(c) Major non-imported material inputs. (They often involve significant tradable material content that is protected);

(d) Unskilled labour. (Its market wage often exceeds its shadow wage.)

Economic project appraisal is in practice often limited to precisely these items. Such has been the case for example, at the World Bank, one of the foremost practitioners of the art for several years. (Change towards a more sophisticated approach has begun recently, however, with the introduction of the methodology proposed by Squire and van der Tak,<sup>32</sup> which follows rather closely that of Little and Mirrlees.) More specifically, the World Bank approach traditionally involved the exclusion of import duties (which in most cases implied in effect the use of border prices) for major inputs and outputs. Also excluded were transfers such as domestic taxes that did not indicate a real use of resources. Finally, where appropriate, labour inputs might be given shadow prices, as might foreign exchange if the exchange rate were obviously distorted.

<sup>31</sup> To quote Vijay Joshi: "There is strictly speaking no theoretical guarantee that decisions based on approximately correct shadow prices will lead the economy in the right direction. In my opinion, an act of faith has to be made if such cosmic doubts are raised about the whole basis of applied welfare economics". ("The rationale and relevance of the Little-Mirrlees criterion", *Bulletin of the Oxford Institute of Economics and Statistics*, vol. 34, No. 1 (February 1972), p. 4.)

<sup>32</sup> *Op cit*

## Fundamentals of shadow pricing

This section deals with some of the basic issues of shadow pricing that must be disposed of before discussing the shadow pricing of specific resources. These issues include the concept of tradability, the sources of shadow prices, the treatment of taxes, the choice of *numéraire*, and the use of adjustment factors.

### *Tradability*

A central issue in shadow pricing is whether a good is “tradable”, that is, can it be imported or exported? If a good is tradable, the international market-place offers an option to domestic production and consumption and thus a measure of its economic opportunity cost or its “real” value to the country in terms of pure efficiency.<sup>33</sup> If, for example, a country decides to produce refrigerators, it must consider the cost of production as against the “trading opportunity cost” of importing them. Conversely, when evaluating the cost of production, if domestically produced steel costing 40 per cent more than the comparable import is to be used, the analyst must consider the trading opportunity cost of importing the steel instead.<sup>34</sup>

The major categories related to tradability are:

- Tradable:** A good that would be imported or exported in the absence of trade barriers such as tariffs and quantitative restrictions.
- Traded:** A tradable that is actually traded.
- Non-tradable:** A good whose real domestic cost of production together with its international transport cost is too high to permit export and too low to make import attractive; in other words, a price higher than f.o.b. but lower than c.i.f. (house foundations are a favourite example).
- Non-traded:** A tradable that is not traded because of the trade policies of the country. Since these may change over the life of the project, an evaluation of likely future trade policies is important.

Each of these concepts applies, of course, to services as well as goods. These terms will be discussed in more detail in the following sections.

<sup>33</sup> Questions of equity are discussed in stage four, and those related to national self-sufficiency in the production of certain goods are considered in stage five.

<sup>34</sup> The use of the international market-place as a source of shadow prices has been attacked by those who believe that choosing projects on this basis will lock countries into their traditional lines of comparative advantage. They argue that the project analyst must look at comparative advantage from a “dynamic” rather than from a “static” point of view. This, however, is not a valid argument against the use of international prices in economic project evaluation. It simply underscores that the analyst should not mindlessly use the present world market price as the shadow price over the entire life of the project; instead, he should predict any future changes in the real price of the good relative to other goods (see p. 11 for a discussion of the treatment of inflation and price movements in project evaluation). It should also be noted that even if the international price does not change in real terms, the discounting of future values to the present recognizes that the project may help the country forge a new area of comparative advantage over time if the costs of production fall as the project moves through its learning curve. In this event the only question is whether the project can reach full efficiency quickly enough to counterbalance the economic losses incurred in the earlier years.

### *Sources of shadow prices*

In a perfect market the shadow price for any resource would be its market price. In this ideal world, the price consumers were willing to pay for one more unit (its marginal value) would be exactly equal to the producer's cost of supplying it (the marginal cost).<sup>35</sup> If the resources were traded internationally, the market price would also equal the relevant border price (c.i.f. for importables; f.o.b. for exportables). The price could not move higher, for consumers would import instead of paying more than the c.i.f. price to domestic producers; and it would not move lower, for producers would export rather than sell for less than the f.o.b. price on the domestic market.

In the real world, because market imperfections such as tariffs, quotas and monopolies create distortions in demand and supply, there is little chance that the market price will reflect the true economic value and cost of inputs and outputs. For tradable resources, the domestic market price is likely to be higher than the border price.<sup>36</sup> Because of market distortions, marginal social cost as seen from the supply side and marginal social value as seen from the demand side for non-traded goods also will probably not be equal. It is therefore necessary to decide whether the project's impact will be on demand or supply to determine its shadow price.

The *Guidelines* recommended three sources of shadow prices depending on the project's impact on the national economy.<sup>37</sup> A project through its use and production of resources may for any given input or output affect the:

- Supply available to the rest of the economy
- Level of its production in the rest of the economy
- Level of its imports or exports

In terms of production of an output the project may:

- Increase total consumption in the economy
- Decrease production in other parts of the economy
- Decrease imports or increase exports

The corollary impacts of a project's consumption of inputs may be:

- To decrease consumption in the rest of the economy
- To increase production within the economy
- To increase imports or decrease exports

A project may have all three of these impacts simultaneously, and they in turn may affect both inputs and outputs. Assume, for example, that at present 20,000 automobiles are produced annually within the country and 20,000 more are imported under a fixed quota. A project is proposed to produce 15,000 units per

<sup>35</sup> Here and throughout the rest of this book, "price", "value" and "cost" should be read to mean "marginal price", "marginal value" or "marginal cost", except where otherwise indicated. Unfortunately, in most cases, average rather than marginal prices for costs and values will have to be used because of a lack of information regarding elasticities of supply and demand at the margin. However, when such information is available, and where the impact of the project is significant in the total market for the input or output, the marginal price should certainly be used.

<sup>36</sup> The main exceptions are (export) goods subject to an export tax or to quantitative restrictions (e.g. petroleum).

<sup>37</sup> See *Guidelines*, chapters 4 and 5. In certain cases it may be appropriate to apply shadow prices on a regional rather than a national basis.

year. As an investment incentive, the government will lower the import quota by 5,000 cars but will maintain this new level indefinitely. Therefore, 5,000 of the 15,000 cars produced by the project will expand the total supply available to the economy. Assuming that this additional consumption will require a decrease in price, a second 5,000 units from the new, more efficient project will replace some of the high-cost production of other domestic producers. Finally, the third group of 5,000 units will substitute for imports because of the reduction in the import quota. The project, therefore, may be said to have all three types of impact. While the *Guidelines* generally speaks of only one impact at a time for a given resource, there is no reason why multiple impacts cannot be considered.

Identifying these impacts is important, since the appropriate source of shadow prices for the cars, for example, is different under each of these three conditions.

<i>Impact</i>	<i>Basis for shadow pricing</i>
Consumption within the economy	Consumer willingness to pay <sup>38</sup>
Production within the economy	Cost of production
International trade	Foreign exchange value

The discussion of the effects a project may have through its use of inputs and production of outputs together with hints for determining the appropriate shadow prices is summarized in the table below.

#### A GUIDE TO SHADOW PRICING

<i>Type of impact</i>	<i>Type of good or service</i>		<i>Valuation</i>
	<i>Input</i>	<i>Output</i>	
Domestic (nontraded)			
Production (supply)	More from local producers	Less by other local producers	Cost of production
Consumption (demand)	Less to other local users	More to other local users	Value to consumer
Foreign (traded)			
Exports (supply)	Less export	More export	Value of export (f.o.b.)
Imports (demand)	More import	Less import	Cost of import (c.i.f.)

*Note: Examples of use of shadow-pricing guide*

##### *Steel for automobile production*

(1) Steel is used as input; (2) impact will be on foreign trade, since steel is traded good (imports); (3) value is cost of imports, since more imports (of steel) will be required.

##### *Unskilled labour*

(1) Labour is used as input; (2) since unskilled labour is abundant domestically, impact will fall on domestic supply of unskilled labour (more labour services will be offered by the unemployed); (3) the supply of value is thus the "cost of producing" an unskilled worker, which may include, for example, the social value of additional consumption (including increased caloric input), the social value of the worker's leisure time forgone, and the cost of providing additional social infrastructure, especially where rural-urban migration was induced.

##### *Skilled labour*

(1) Labour is used as an input; (2) since skilled labour is scarce, but wages are not sufficient to attract workers from abroad, most important impact of project will be on the domestic demand for skilled labour—less will be available to other local users (employers); (3) the shadow price is thus the value to other consumers (employers) of services of skilled labour.

<sup>38</sup> The consumer will be other producers in the case of capital and intermediate goods.



This table can be used to determine the factors that should be considered in calculating shadow prices in virtually any situation. The principles outlined in it can be seen in the following example, which is a continuation of the motor car case from above.

First, the 5,000 cars that increase the number consumed in the economy should be valued at the price consumers are willing to pay for the additional cars.<sup>39</sup> However, this price is not necessarily the current price in the market. For the market price to be the appropriate shadow price four conditions must hold:

(a) The good is freely available to anyone who is willing to pay the market price. In the case of goods whose supply is artificially restricted, e.g. by a quota limit on the production of cars, the market price must be high enough to limit demand so that the number of willing customers does not exceed the number of cars available;

(b) No customer buys enough of the total output to exercise monopoly buying power (monopsony). Monopsony would artificially lower the market price below actual consumer willingness to pay;

(c) The change in the supply of resources available to the rest of the economy does not change their price. In other words the project is so small that its consumption or production is negligible with respect to the total domestic market of the good in question. If the project's demand will raise the price of inputs or if its output will lower the market price of the output, this must be taken into consideration. More technically, unless the demand and supply of the project are very small relative to the domestic and international markets for the respective inputs and outputs, price elasticities of supply and demand will have to be considered at the margin. If the elasticities are non-zero, producer and consumer surpluses should be considered. If, for example, prices go down in the face of increased supplies, some consumers will pay less for the product than they paid before and would still be willing to pay. The "benefit" they receive over and above what they actually pay is consumer surplus and theoretically should be included in the measurement of the benefit of the project. *In practice*, however, it may be safe to ignore consumer surplus, for projects are often marginal in that they have a minor impact on total consumption or on the price paid. Also, adequate information to measure any consumer surplus that may be generated is often not available. Furthermore, because of the lack of information on consumer demand for various goods, and because consumer surplus is usually not measured when the profitability of projects is evaluated, the nationwide opportunity cost of capital probably does not adequately reflect the consumer surplus that is generated by investment in general. Thus, the inclusion of this surplus for a specific project may well result in the relative overstatement of its benefit. If the information required to make these various adjustments is available and is thought to be reasonably reliable, it should, of course, be taken into account. If it is not available, but there is reason to believe that consumer surplus is significant, the analyst should indicate that the calculated rate of return is a minimum estimate of the project's benefits.<sup>40</sup>

<sup>39</sup> It is assumed here that the number of vehicles imported is fixed so that the additional consumption would not be met by imports. Under more liberal assumptions about trade policy, the increased consumption would otherwise have come from imports, and the project's output should be valued at border prices.

<sup>40</sup> Consumer surplus is often sufficiently important in certain types of infrastructure projects to justify the effort to estimate it.

(d) With respect to inputs only, the market price is not artificially inflated by producers who make monopoly profits on their output.

If these conditions do not hold, adjustments will have to be made in the market price to obtain the "true" consumer willingness to pay. *In practice*, these assumptions are probably sufficiently well met to be accepted in most cases, except those involving projects that are quite large relative to the total size of the sector within which they operate.

Secondly, the 5,000 cars that would decrease other domestic production should be valued in terms of the marginal social cost of production of less efficient domestic producers whose production will be replaced (the net benefit of this part of the project would be the present cost of the inefficiently produced cars less the cost of producing them in the new project). The analysis of production costs of competing firms should, of course, be done in terms of shadow prices, which would in some cases lead to applying analysis of the same type to the project's competitors.<sup>41</sup> *In practice*, this type of input-output disaggregation analysis can quickly become too difficult to be worth while, and it should be carried out only to the extent that resulting modifications in shadow prices are significant vis-à-vis the total project and to the extent that the expected modifications exceed uncertainties inherent in the calculations.

Finally, the 5,000 cars that would substitute for imported vehicles should be valued at border prices, for their contribution to the economy is to reduce foreign exchange expenditures by their c.i.f. value.

It may appear at first sight that the c.i.f. value would understate the value of the cars to the economy, since consumers are willing to pay a substantially higher price for them. Two points should be made in response. First, as far as the consumers are concerned, no additional value is attached to the domestically produced cars, for they only substitute for the imported cars that are already consumed. The only real change is in the economic cost of supplying the cars. This change is equal to the difference between the cost of the cars from the project and the cost of the imported cars. Since the cost of the cars from the project is already included as part of the total project output cost, adding the c.i.f. value of the import-substituting cars as a benefit produces a net cost figure equal to the difference between the foreign and domestic supply costs. If the domestically produced import substitutes cost Rs 20,000 each and the imported ones cost Rs 15,000 each, the net benefit to the country is actually a minus Rs 5,000, at least as a first approximation. Secondly, however, since the UNIDO method uses domestic accounting rupees as the *numéraire*, the value of the cars measured at their border prices must be increased if foreign exchange is more valuable to the economy than the market exchange rate would indicate. To do this, the c.i.f. price values must, either individually or collectively, be converted to domestic currency values at the shadow rather than the market foreign exchange rate. Such an adjustment may well change the above-mentioned negative value of Rs 5,000 to a positive value. These adjustments will be handled at the end of stage two in this *Guide*.

*In practice*, it is generally appropriate to use border prices on the assumption that additional demand would in the absence of the project be met from the world

<sup>41</sup> This input-output type of analysis should also be used when the project's use of inputs stimulates increased domestic production of inputs, whether partially traded or non-traded. There is thus a substantial similarity between the UNIDO and Little-Mirrlees methods in this respect.

market unless (a) domestic production costs are lower, or (b) there are “permanent” trade barriers that prevent access to the world market. This assumption maintains the emphasis in stage two on economic efficiency; the national priorities reflected in tariffs are considered in stage five (pp. 75-77).

### Taxes

Taxes often pose problems when efficiency shadow prices are being calculated. *In practice*, the general rule to use in stage two of the UNIDO analysis is that when a project takes non-traded inputs that are in fixed supply away from other producers or adds non-traded consumer goods, taxes should be included as part of the indication of the consumer willingness to pay the marginal economic value. However, if the impact is to generate more domestic production of inputs or to reduce domestic production of the project’s output by other producers, taxes should be excluded, for they do not constitute part of the marginal economic cost of production. Taxes should be ignored for fully traded goods.

This rule is applicable, however, only to determine the basic economic-efficiency shadow price required in stage two of the UNIDO analysis. The analysis at this stage does not face the questions of the relative value of income in private and public hands (and thus the social value of taxes), nor does it face the question of other national objectives such as a desire to reduce consumption of products thought socially undesirable like alcohol and tobacco. Likewise, stage two does not address the problem that “value” measured in terms of the willingness of wealthy consumers to pay for fancy cars may be less socially valuable than “value” measured in terms of the willingness of poor consumers to pay for animal-drawn ploughs.

If the need to generate government revenue is an important consideration, taxes will be taken into account in stage four, where the transfer of income from private to government hands is considered. Likewise, if there is reason to believe that the government values tobacco and alcohol, for example, at less than their market price for moral reasons, or that it values ploughs or “basic needs” more highly than cars for social reasons, the analysis of stage five should be used to deal with the issue.

### The *numéraire*

One of the first steps in shadow pricing is to determine the unit of account, or *numéraire*, in which the values of inputs and outputs are to be expressed.

A *numéraire* is the unit of account in which unlike quantities are expressed so that they can be added up. Its complexity depends on the differences among the items to be summed that are thought worthy of consideration. For example, if a farmer wants to take a load of potatoes and squash to the market and is concerned only about the weight his truck can carry, he will use a very simple *numéraire*, the kilogram (8 potatoes or 1 squash per kg, for example). But if the farmer wants to know the value of his truck load, he will have to use a slightly more complex *numéraire*. The rupee would be very appropriate, for both potatoes and squash can be expressed in terms of this common unit (e.g. 3 potatoes per rupee and 1 squash per rupee). The following paragraphs discuss some of the concepts generally taken into consideration when establishing a *numéraire*.

### *Inflation*

A unit of domestic currency is the *numéraire* most commonly used in business; it is also the *numéraire* in stage one of the UNIDO approach, where the commercial profitability of the project is measured. But even for this purpose the domestic-currency unit used in this book, the rupee, may not be a sufficiently sophisticated *numéraire* as measured in the market. Inflation can easily exaggerate the value of costs and benefits, which would lead to incorrect conclusions. To avoid such errors, a special *numéraire*, called the "constant" dollar or "constant" rupee, must be created. It is impossible to go into the market and find a constant dollar or a constant rupee, but this imaginary unit of account serves a valuable purpose: it allows the measurement of benefits and costs in a unit of account that is not distorted by inflation.

### *Present value*

In choosing a *numéraire*, we must next consider the problem that a constant dollar of benefits received 10 years in the future is not so valuable as a constant dollar of benefits received today. A dollar received today can be invested at, say, 8 per cent per year interest and will be worth \$2.16 in 10 years. Put the other way around, if the interest rate is 8 per cent per year, \$2.16 received 10 years from now is worth only \$1.00 received today, even if both are expressed in constant prices. Hence yet another quality of the *numéraire* must be introduced: present value. To compare costs and benefits from different years of the project's life, it is necessary to discount them all to the present by the rate of interest and express them with a *numéraire* in terms of present value.<sup>42</sup>

### *Shadow prices*

A *numéraire* in real, present-value terms is generally sufficient for most commercial calculations. However, in stage two of the UNIDO analysis, attention focuses on the fact that from the point of view of national benefit, a car produced domestically for Rs 30,000, for example, may be worth far less than a load of wheat produced domestically with an export value of Rs 30,000. Without going into details at this point, if the car could be imported for only Rs 15,000, the other Rs 15,000 being made up of excessive domestic manufacturing costs and monopoly profits, a rupee of car is worth only 0.5 rupee of wheat (Rs 15,000/Rs 30,000) from the point of view of economic efficiency. Since economic project evaluation must always take into account such differences between the national and the private value placed on goods, a *numéraire* is needed that also takes such differences into account. The usual approach is to use either border prices or domestic accounting rupees. Border prices are used in the Little-Mirrlees method, while domestic accounting rupees are used in the UNIDO method.

The UNIDO approach involves assigning a premium to the border price of goods expressed at the market exchange rate to take account of the value that foreign

<sup>42</sup> For a full exposition of this concept, see, for example, H. Bierman and S. Schmidt, *Capital Budgeting Decision*, 4th ed. Collier Macmillan, 1975.

exchange has to the country over and above that indicated by the market exchange rate. The border price of each product is calculated at the market exchange rate. For example, if the wheat is worth \$3,000, the car is worth \$1,500, and the market exchange rate is Rs 10 per dollar, the prices in border rupees will be Rs 30,000 and Rs 15,000, respectively. If the shadow price of foreign exchange<sup>43</sup> is Rs 20 per dollar, the premium on foreign exchange is in effect 100 per cent. Border prices expressed in terms of foreign exchange or the equivalent border rupees therefore have to be increased by 100 per cent to translate them into domestic accounting rupees.<sup>44</sup> This is done in the UNIDO method by adding a premium of 100 per cent on the foreign exchange impact,<sup>45</sup> which would raise the price of wheat to Rs 60,000 expressed in domestic accounting rupees (Rs 30,000 in border rupees plus 100 per cent of the foreign exchange impact in border rupees of Rs 30,000). This approach would also raise the price of the car from Rs 15,000 in border rupees to Rs 30,000 in domestic accounting rupees.

Three very important things should be noted. First, and most important in terms of the *numéraire*, the relative price of wheat to cars is 2:1, whether expressed in domestic accounting rupees, border rupees or dollars. Thus, the choice between domestic accounting rupees and border rupees or foreign exchange makes no difference to the results. Secondly, the rather awkward term “domestic accounting rupees” must be used to distinguish these results from those measured in terms of simple market rupees, for the latter reflect market-price relationships while the former reflect shadow-price relationships. Thirdly, the use of domestic instead of foreign currency as the *numéraire*, provided that the “currency” is accounting rupees and not market rupees, does not mean that domestic market-price relationships are used; the shadow-price relationships must be determined in either event.

It would also be well to note that, in the UNIDO method, instead of deflating non-tradables to border prices as is done in the Little-Mirrlees method, tradables are raised to average domestic price levels. Provided that the value of tradables at border prices is understated to the same extent that non-tradables in domestic prices are overstated, either approach will give the same conclusions about the relative desirability of projects despite the different *numéraires*.<sup>46</sup> In both methods the relative shadow prices of tradables and of the tradable contents of non-tradables have to be sorted out by reference to border prices.

To recapitulate, if the analyst is interested in expressing the relative economic values of inputs and outputs instead of just their relative market values, he must use a

<sup>43</sup> The derivation of the shadow exchange rate is described on p. 48.

<sup>44</sup> This concept is explained on pp. 45-46.

<sup>45</sup> The Little-Mirrlees method uses “border rupees” and “accounting rupees” synonymously. This is possible only because the Little-Mirrlees unit of account is the border rupee (convertible foreign exchange equivalent expressed in local currency units). Since the UNIDO unit of account is domestic consumption, the accounting rupee must be a domestic rather than a border accounting rupee.

<sup>46</sup> For this identity to hold, shadow pricing must be carried to the same detail in both methods and be based on the same assumptions. Because of the *numéraire*, there is a certain tendency with the UNIDO method, which uses local currency, to assume that goods are non-tradable and have no foreign exchange impact. On the other hand, there is some tendency with the Little-Mirrlees method to use border prices even for goods that should be treated as non-tradable. To continue the analogy begun in footnote 5, although physical realities may be measured with equal accuracy using either the English or the metric system, there is a tendency to design machines in even centimetres and millimetres in countries using the metric system and in even inches or fractions thereof in countries using the English system.

*numéraire* based on economic values. This aspect of a *numéraire* is flagged by various expressions, including “border rupees”, “domestic accounting rupees”, and “free foreign exchange” (also known as “world prices” or “border prices”).

### *Savings and consumption*

Another factor the project analyst may wish to take into account is the impact of the project on savings and thus on investment. Some projects, especially those with a high labour content, may generate substantial increased consumption, while others, especially those with a relatively high capital intensity, may generate more than average savings and reinvestment. If savings are more valuable to the country than consumption, which is often the case in developing countries because of the scarcity of capital, a rupee of benefits going to savings will be more valuable than a rupee of benefits going to consumption. If this difference in value is to be taken into account, it will be necessary to establish a *numéraire* in terms of consumption, for example, and convert benefits saved into their higher equivalent consumption value. The UNIDO method has adopted this approach (see stage three). The Little-Mirrlees method has adopted the opposite approach, discounting consumption to its savings equivalent.

### *Distribution*

Stage four of the UNIDO method deals with still another facet of project evaluation that cannot be considered unless a further specification is added to the *numéraire*: who will receive the benefits? If the country is seriously interested in a more equitable distribution of income and has been unable to achieve it through taxation and subsidy, the government may wish to place a higher value on income going to the poor than on income going to the rich. Similarly, if the government finds it difficult to generate the revenue it needs through taxation, it may place a higher value on benefits going to the government either directly or through taxation than it places on benefits going to the private sector.

Although the original *Guidelines* emphasizes the importance of income distribution in project selection, it is not explicit in its definition of the appropriate *numéraire*. The *numéraire* of the *Guidelines* as most readers interpret the text is aggregate consumption. This *numéraire* has been challenged on the basis that it does not specify the income class in whose hands this aggregate consumption is measured.<sup>47</sup>

To clarify the point, this *Guide* uses as its *numéraire* consumption in the hands of persons with a “base level of consumption”;<sup>48</sup> additional income going to a person at the base level of consumption is considered by the government to be as

<sup>47</sup> Income-distribution impacts in the *Guidelines* are in effect considered in addition to the aggregate-consumption benefits and are treated as a matter of additional analysis incorporated only in the final decision making. “It is diametrically opposed to the purpose of these *Guidelines* to suggest that aggregate consumption is the sole objective of public investment, and contributions to it the sole test of the national economic profitability of an investment. It seems sensible to consider departures from consumers’ valuations as the result of additional social objectives and to reserve the term ‘aggregate consumption’ to measure the value of consumption as consumers see it.” *Guidelines*, p. 40.

<sup>48</sup> The author is indebted to Little and Mirrlees for the concept of the “base level of consumption”, which they expound in much more detail than is possible here in *Project Appraisal and Planning for Developing Countries* (London, Heinemann, 1974), p. 238.

valuable as additional income going to the government itself. *In practice*, this level may be estimated by observing government taxation policies. Below the base level of consumption, the government will provide subsidies, which indicates that it places higher value on private income at such levels than on its own. Above this level, the government will impose personal income taxes (generally of a progressive type that increase with the level of income), which indicates that it places a lower value on private income at such relatively high levels than it does on its own revenues.

The base level of consumption, besides being an easily understood point of reference, has the further advantage that income at this level is equal in value to government income, which means that government income can be added directly to appropriately valued private income without further adjustment.<sup>49</sup> For income going to those below the base level, the adjustment factor will be positive because of the higher value of such income, while the factor for that going to the higher-income classes will be negative. (The calculation of the actual adjustment factor is spelled out in stage four.)

Once income at the base level of consumption has been specified as the *numéraire* for purposes of distributional analysis, it is possible to take into account not only the different values of income received by the rich and the poor, but also of income received by the private and the public sector, by backward and advanced regions, and by citizens and foreigners.

#### *Summary*

If a *numéraire* is to serve the purposes of economic and social project analysis, it must include specifications with respect to the:

- (a) Unit of currency used to express the benefits and costs (domestic or foreign);
- (b) Value of the currency with respect to inflation (current or constant);
- (c) Point when costs are incurred benefits are received (past, present or future);
- (d) Relative price or value system used (domestic market or foreign trade);
- (e) Use that will be made of income from the project (consumption or investment);
- (f) Recipient of the income (rich or poor, government or private etc.).

The full specification of the UNIDO *numéraire* in terms of these criteria would thus have to be “net present-consumption benefits in the hands of people at the base level of consumption in the private sector in terms of constant-price domestic accounting rupees”.<sup>50</sup>

It should be stressed that, while the *numéraire* defined above is highly useful, it is still very much an artificial creation. Although the *numéraire* permits diverse values

<sup>49</sup> A distinction is made later in this *Guide* between government income which is saved and that which is invested (see footnote 97).

<sup>50</sup> Technically, if the appraisal is to focus strictly on economic benefits to the country, “people” should be further specified to mean “citizens living in the country who do not send any money abroad”, but this is a minor point and makes expression of the *numéraire* even more awkward. Also, the inclusion of stage five (social values) technically requires yet another specification of the *numéraire*. In the case of sumptuary objectives such as limiting the consumption of alcohol and tobacco, the *numéraire* would have to be modified to read “socially acceptable aggregate consumption”. *In practice*, this refinement for social objectives other than income distribution would have limited application.

to be measured in terms of their equivalent units of *numéraire* value, it does not mean that these values exist in reality, any more than purple cows would exist if we were to assign a value of one to purple cows and measure everything in terms of this *numéraire*. This problem is critical from an operational point of view, especially if substantial weights are assigned in the measurement of income-distribution impacts. A project might, for example, show a social profit or net present value at the end of stage four equivalent to Rs 10 billion of consumption because all the benefits went to the very poor, but the project still could have a negative net present value in terms of economic efficiency. Another way of looking at this problem is to say that, given the weights the country has assigned for purposes of converting values into their equivalent at the base level of consumption, this project with a negative net present economic value but great benefits to the poor is just as valuable (from a social point of view) as a project with an economic net present value of Rs 10 billion from which all benefits go to the government (whose income by definition is at the base level of consumption). This cautionary note is not intended in any way to cast doubt on the validity of the *numéraire* approach; rather it is to stress that in using *numéraires* we are dealing in equivalent and not absolute values.<sup>51</sup>

### Adjustment factors

Adjustment factors are used in this *Guide* to transform the financial values found in the standard financial tables into economic values. They indicate the premium that must be added or the discount that must be subtracted to reflect the differences between financial and economic values. They are also used to adjust values when moving to the third, fourth and fifth stages of the UNIDO analysis. As such, the adjustment factors are closely related to the well-known conversion factors or accounting ratios in the Little-Mirrlees method. In fact, if the same economic values have been assigned in both cases, the adjustment factor is equal to the conversion factor minus unity; as such, it provides an additive adjustment rather than being a multiplicative factor. For example, if the market wage is Rs 10 per day and the shadow wage is Rs 6 per day, the conversion factor for wages is Rs 6/Rs 10, or 0.6, while the comparable adjustment factor would be (Rs 6/Rs 10)–1, or –40 per cent. Annex II examines in mathematical terms the nature of conversion and adjustment factors.

While there is absolutely no theoretical superiority to the adjustment-factor approach compared with the conversion-factor approach, it does have some practical advantage in the stage-by-stage adjustment approach used in this *Guide*. By focusing only on the discounts or premiums that have to be applied when moving from financial to economic prices, and by working only with present rather than yearly values, the analyst can calculate only the difference between the economic and financial present values and use it to adjust the overall financial net present value to obtain the economic net present value. If conversion factors were used instead, it would be necessary to work with all values, even if the conversion factors were unity (1.0). All shadow prices discussed in the following chapter will, therefore, be expressed in terms of positive or negative percentage adjustments to the financial present values derived in the analysis of stage one.

<sup>51</sup> A similar warning applies to the Little-Mirrlees foreign exchange *numéraire*. A project whose benefit is measured in social terms at \$10 million does not necessarily produce \$10 million of foreign exchange in the Central Bank; this only says that the project is as valuable to the country as one that would.



## IV. STAGE TWO: DIRECT ECONOMIC BENEFITS— SPECIFIC APPLICATIONS

This chapter first outlines the essentials of shadow pricing inputs and outputs according to the principles outlined earlier, then introduces the mechanical adjustment from market to shadow prices based on adjustment factors. An example using data from the sample standard analytical tables is presented at the end of this chapter.

### Shadow pricing of specific resources

#### *Tradable inputs and outputs*

The *Guidelines* tends to predict that tradable goods that are not freely traded today will not be freely traded in the future and should be treated as non-tradable goods.<sup>52</sup> Existing trade policy in most countries is such that some goods are fully traded, others are partially traded, and the remaining are non-traded.

A good is fully traded if the impact of any increased consumption will result in more imports or fewer exports or if any increased production will result in more exports or fewer imports, other things being equal. For such goods there is no change, for example, in the level of domestic production if domestic demand increases; all the additional demand will be met by imports. Conversely, any additional domestic production, such as that from a project, will be exported and will not affect either consumption or price on the domestic market. For such fully traded goods, the shadow price is the border price, converted to domestic currency at the market exchange rate. At the end of this chapter the adjustment for the project's foreign exchange saving by import substitution or export expansion is described, along with the converse adjustment for the use of imports or exportables as inputs.

A good that is fully traded is not necessarily freely traded, unencumbered by import or export taxes. To be fully traded, it is only necessary that domestic changes in demand or supply affect just the level of imports or exports. However, to take the example of imported inputs, for the impact of a project's demand to fall solely on trade, thus leaving the market price and domestic production unchanged, the following conditions must be met:<sup>53</sup>

<sup>52</sup> Although this philosophy is implicit in many places in the *Guidelines*, it is stated explicitly and concisely by one of the authors in another publication: "(The Office of the Central Project Evaluator) is to accept the state of the economy as given, and it is to accept as given the policies of the government (including any influence that the OCEPE may have.)" Partha Dasgupta, "A Comparative Analysis of the UNIDO *Guidelines and the OECD Manual*", *Bulletin of the Oxford University Institute*, vol. 34, No. 1 (February 1972), p. 36.

<sup>53</sup> The list of conditions was developed in part by Vijay Joshi in "The rationale and relevance of the Little-Mirrlees criterion", *Bulletin of the Oxford University Institute of Economics and Statistics*, vol. 34, No. 1 (February 1972), pp. 14-16. Converse conditions apply to exportables.

(a) If the goods are subject to an import quota, the available quantity is at present either only partially taken up or the quota will be expanded to allow all additional demand for inputs to be met in the international market;

(b) The import supply tends towards perfect elasticity over the relevant range of import volumes, which implies no rise in supply cost and thus no decrease in demand;

(c) There is no excess capacity in the domestic industry; all additional supply must come from abroad. If there is any domestic excess capacity, it must be due to shortages, not of demand, but of necessary inputs that will remain unavailable;

(d) If the additional demand occurs inland, transport costs from the port of entry do not raise the cost of imported goods above the marginal cost of local production, so that imported goods are still cheaper;<sup>54</sup>

(e) The import price of the input, including taxes, is less than the domestic marginal cost of purchase (including taxes, profit margins etc.).

Under these conditions, the input is fully traded, even if it is subject to say, a 40 per cent tariff; additional demand would fall entirely on external trade because, despite the tariff, the input could be obtained more cheaply by importing it than by purchasing it domestically at higher marginal costs. Similar conditions must hold for importable outputs and for exportable inputs and outputs to be considered fully traded. *In practice*, it is probably best to assume that tradable inputs and outputs are fully traded, even if the above-mentioned conditions are not met perfectly. The border price is thus the relevant shadow price.

A good is non-traded if it is tradable but conditions (a) through (d) do not prevail and are not expected to in the future, so that the border price no longer reflects its economic value. A non-traded good must be valued at its marginal economic value, the amount domestic consumers are willing to pay for an additional unit, if its production makes additional supplies available to consumers or if its use as an input takes it away from other users. A non-traded good must be valued at its marginal economic cost, the cost of producing an additional unit, if the project induces additional production or decreased production by less efficient domestic competitors. In other words, if a non-traded good is not expected to become a traded good with policy changes, it should be treated as a non-tradable.<sup>55</sup>

#### *Non-tradable inputs and outputs*

If condition (e) above does not hold, the good is a natural non-tradable, one that cannot be imported from abroad because the costs of international transport raise the border price for imported equivalents above the domestic cost of production. This is true, for example, of building foundations, haircuts, and often of goods such

<sup>54</sup> Border prices should always include any internal importing costs such as transport if the market is farther from the port than from the project. Any differences in the levels of stocks required to cover the risk of unexpected needs or delayed shipments from domestic or foreign sources should also be considered if thought to be potentially important.

<sup>55</sup> Refer back to p. 25 for a brief discussion of the problem of measuring the surplus that may arise if the elasticity of demand or supply and the degree of change in demand or supply are significant.

as soft drinks and electricity. To be completely non-tradable, the domestic cost of production must also be above the f.o.b. price; otherwise, the product would become exportable and would be valued at its f.o.b. border price.

The valuation of non-tradables is guided by the basic principles of shadow pricing outlined in the previous chapter. If the only impact of additional production is to increase consumption within the country, the marginal consumer willingness to pay is the relevant shadow price. If additional production replaces other production of the same non-tradable good within the economy, the alternative production costs avoided are the measure of value. On the input cost side, if additional production of the good (tradable or not) reduces the availability of one of its non-tradable inputs to other producers, their willingness to pay for this input is the shadow price. If the project's demand for the input generates additional domestic production of the input, production costs of the non-tradable input are relevant. In the latter case, the international trading opportunity cost (border price) may again become relevant. For example, a project may require inputs of civil works (e.g. buildings), which are not tradable. However, the production of such buildings involves the use of cement, timber, steel, bricks, earthmoving equipment and fuel, all of which are tradable. Thus, rather than take the domestic market price for the building (which may, for example, reflect heavy duties on cement and steel, and perhaps even a monopoly profit by the contractor), the cost of producing the building should be broken down into its components. Each tradable component should then be valued at its border price. The labour should be valued at its shadow wage. If the residual non-tradable items are major (earthmoving services, for example), they should be broken down further into their tradable, labour and residual non-traded components; if they are minor, they can be valued at domestic willingness to pay.

*In practice*, however, it will probably be sufficient to calculate a general adjustment factor for basic categories of non-traded inputs and outputs (e.g. civil works and transport services). These general adjustment factors can then be used to adjust the net present values of such inputs accordingly. The residual will be left in market rupees, and all other inputs and outputs that have been valued at border prices throughout this section will be revalued according to their foreign exchange content or impact on domestic price levels by the premium on foreign exchange as indicated later in this chapter.

### *Externalities*

Externalities may be considered a special class of non-traded goods that may be either positive or negative. These "goods" or "bads" do not have a market price and in some instances may by law or custom, be "given away" (e.g. free worker housing or free worker health care). In other instances, society has not designed a mechanism for charging beneficiaries or for paying producers. Positive externalities arise, for example, from workers' training, but the beneficiaries pay no charge; equally, negative externalities arise from air pollution, but those adversely affected are not compensated. *In practice*, however, an economic value can be imputed to resources such as housing for workers on the basis of comparable facilities for which a price is charged (e.g. other housing in the area); similarly, an economic cost can be imputed on the basis of a "reasonable" return to capital given the investment necessary to provide the facilities. The *Guidelines* mentions external economies and diseconomies

such as pollution<sup>56</sup> and encourages their inclusion when possible. *In practice*, knowledge of the economic value of such externalities is limited; but when non-marketed inputs and outputs can be valued, their net present value should be added to the net cash flow in the standard cash-flow table (table 2, line 1.1.4).<sup>57</sup> It may even be reasonable in certain cases (e.g. a hotel that will make possible a wide range of supporting economic activity such as growing food for the hotel, running tours, and making handicraft items) to define the project more broadly so as to “internalize” in the accounts of the project the “external” benefits and costs of such derivative activities. Even when the environmental impacts of a project cannot be valued in terms of money, some qualitative evaluation should be made in the project summary statement (see chapter IX and table 16).

### *Labour inputs*

Labour is usually thought of as a service rather than a good, but the principles of shadow pricing used for goods apply here just as well. The analyst must consider the project's impacts on the rest of the economy when it hires labour: the project may take labour away from other users; it may stimulate the “production” of new workers; and it may cause the importation of workers.

In more conventional language, the first type of impact, taking labour away from other users, refers to situations where workers are already employed, and thus it is necessary to consider the production that would be given up if they left to work in the proposed project. Since this situation usually applies to relatively skilled workers, *in practice* it may be reasonable to assume that they are being paid a competitive wage that reflects fairly well their marginal product and hence their economic value. (Caveats to this assumption are discussed below.) The most clear-cut situation reflecting the second type of impact, where the project induces the “production” of new workers, is that where the workers were previously unemployed. Here it may be reasonable to assume *in practice* that the production that would be given up is virtually zero. However, since the worker will be unwilling to supply his labour for less than some minimum wage, a positive shadow wage will probably be appropriate. The other examples of the second type of impact are less clear-cut and thus are not amenable to any even tentative assumption. The improved productivity of underemployed workers, urban employment of rural workers and skilled employment of previously unskilled but fully occupied workers all involve many variables both in terms of costs and benefits. The third and final type of impact, the hiring of workers from abroad, has a clear-cut economic cost in most cases.

At this stage in the UNIDO analysis, the shadow price reflects only the economic efficiency cost of labour. The impact on savings and consumption of hiring labour is analysed separately in stage three, while the impact on income distribution is reviewed in stage four. This step-by-step approach sets the UNIDO method apart from the Little-Mirrlees method, where the social costs and benefits of employing workers are built into the shadow wage rate. The UNIDO method is, therefore, advantageous

<sup>56</sup> See *Guidelines*, pp. 64-67.

<sup>57</sup> A very useful discussion and check-lists of the environmental factors that should be considered in appraising projects can be found in *Environmental, Health and Human Ecologic Consideration in Economic Development Projects* (Washington, World Bank, 1973) and in R. F. Dasmann, J. P. Milton and P. H. Freeman, *Ecological Principles for Economic Development* (London, Wiley, 1973).

in that it identifies explicitly the economic cost of pursuing social objectives.<sup>58</sup> It also permits the effects of income distribution that lie outside wage effects to be included, for example, the impact on poor consumers of paying rich manufacturers inflated prices for heavily protected products.

For the first type of impact, drawing workers away from alternative employment, the shadow price will be the willingness of other users to pay for this labour. If the market is relatively free, it will correspond to the marginal product of such workers. This product, and thus the shadow wage rate, may, of course, vary from season to season, in which case, to facilitate computation, a weighted wage-rate adjustment factor should be calculated according to the amount of labour the project will require in each season. It may be argued that if the government keeps wages artificially high through minimum-wage legislation or if there is a strong union, this approach would overstate the shadow price of the labour. However, minimum-wage legislation usually affects only the relatively unskilled workers, and there is generally unemployment among this class. Therefore, since employment of unskilled workers from the informal sector by the project will, in the final analysis, usually not take them away from employment in the formal sector, the marginal willingness to pay will not be the appropriate shadow price anyway. For skilled workers in the formal urban labour market, however, union pressures may be a problem, for they can artificially raise wages and, through apprenticeship practices, restrict the number of skilled workers available, thus inducing employers to substitute capital. This substitution will keep the marginal product of skilled workers up to their market wage, but creates an inefficient use of resources. In theory, the number of workers will increase in the absence of the union pressures, their marginal product will fall, and the price employers will be willing to pay will drop accordingly. *In practice*, however, if the project demands for union labour are relatively small in comparison with total supply and if the market for such union labour is relatively free in all other respects, it is probably reasonable to use the market wage for such skilled workers even if unions do exist.<sup>59</sup>

The second type of impact, inducing the “production” of additional workers, is most important in four situations:

- Employment of previously unemployed workers
- Improved productivity of underemployed workers
- Urban employment of rural workers
- Skilled employment of previously unskilled workers

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<sup>58</sup> Theoretically speaking, all prices are interdependent and should, therefore, be calculated simultaneously as in the Little-Mirrlees method rather than applying certain prices at one stage and others at another. In practice, the UNIDO analysis in stages is not likely to result in serious errors and may actually result in better investment decisions because the decision makers can see the costs of pursuing various objectives and because the costs are not all lumped together in a single number that is difficult to decipher. This feature is reinforced through use of the summary table suggested in chapter IX (see table 16).

<sup>59</sup> The marginal product of the workers referred to in this paragraph is measured in market terms, at least as a first estimate. However, the economic value of this marginal product can vary widely with the degree of protection enjoyed by the industry in which the workers are employed. Appropriate adjustments should in theory be made if the workers of the skill required by the project are primarily employed in highly protected industries where marginal revenue products and thus wages rates tend to be inflated above the average. (Average rates of protection are, of course, taken care of by inflating border values to the levels of domestic accounting by the foreign exchange adjustment factor.)

The term "production" is used here in an admittedly unusual way to focus attention on the fact that the analytical tools used above for material inputs are equally appropriate when examining labour inputs. Also, as is implicit in this list of four situations, the "production" costs do not refer to the initial creation of the workers; the externalities of this process are generally sufficient to outweigh the costs. Rather, they refer to the transformation of a non-worker into a worker, a partial worker into a full-time worker, a rural worker into an urban worker and an unskilled worker into a skilled worker. All these transformations may, of course, occur simultaneously, but for clarity they are analysed separately here.

The basic cost of transforming an unemployed worker into an employed one is zero if the worker is truly unemployed, i.e. if his product is zero. Here is the source of the classical zero shadow wage rate, because in such instances society gives up nothing to gain the additional worker.

A closer look, however, raises at least three doubts about the validity of a zero shadow cost for producing such a worker.

First, will he need more to eat if he starts working? There is substantial evidence that caloric intake must rise significantly when a previously idle person begins working, especially at hard manual labour. If so, society must invest in additional food consumption, roughly the caloric equivalent of 0.5 kilogram of rice per day.<sup>60</sup>

Secondly, will the worker be willing to forgo his leisure if not paid for his work? Generally the answer is no. The increased value of leisure after work and the psychological benefits of the work itself may partially compensate for the loss of leisure during work and for the effort required. None the less, a wage of some type will usually have to be paid to induce the person to work; the equivalent of 3 kilograms of grain per day is often quoted as a world-wide average.<sup>61</sup> *In practice*, if better information is lacking, it may be used as a first estimate of the shadow wage for unskilled workers.

The amount of this so-called reservation wage will depend on:

(a) The income the person already enjoys through transfer payments (e.g. shared family income or welfare payments);

(b) The expectations he holds regarding acceptable jobs (which may in part be dictated by the costs of education);

(c) His own psychological preference for work and leisure.

Each of these factors is obviously very much a function of the culture within which the project is to function. Consequently, it is virtually impossible to give any brief guidance about reasonable values to be imputed due to these factors for use "in practice". If it appears to be worth the effort to refine shadow wages to take account of such factors (and it may be, for example, in a large rural public-works project),<sup>62</sup> a detailed on-site socio-economic study will be required.

<sup>60</sup> Caloric requirements for hard work are twice basal requirements. See Cooper's *Nutrition in Health and Disease*, 15. ed. (Philadelphia, Lippincott, 1968), p. 52. Thus an average-sized man, who would require the caloric equivalent of about 0.5 kilogram of rice per day when completely idle, would require an additional 0.5 kilogram when doing heavy labour.

<sup>61</sup> Colin Clark and Margaret Haswell, *The Economics of Subsistence Agriculture*, 4. ed. (London, Macmillan, 1970), p. 139.

<sup>62</sup> The serious problems encountered in attracting the required labour force for such projects even in areas of serious unemployment are discussed, for example, by S. V. Sathuraman in *Underemployment in Rural India: Implications for Rural Works Programme* (New Delhi, USAID, 1972).

Society may, of course, assign a lower or even negative value to the disutility of effort compared with that assigned by the individual, because of the political turmoil often created by the unemployed and the costs of welfare payments, among other things. However, regardless of the price society assigns to the disutility of effort, the worker will have to be paid at least his reservation wage unless the government practises labour conscription (e.g. for occasional local road work as a form of taxation).<sup>63</sup> Similarly, for skilled workers who are fully employed, there may be a reservation wage somewhat higher than the present market wage to induce them to pull up roots and move to a new job.

Thirdly, will the market wage paid by the project encourage the worker to spend more on consumption, thus taking resources away from other users? If so, his increased consumption may in turn have a negative impact on savings and investment in the country. This aspect of the shadow wage rate is identified separately in this *Guide* in stage three.

The cost of transforming an underemployed person to a fully employed worker is the cost to society of giving up what little he may have produced in his former employment, his marginal product. In the case of agricultural projects, the opportunity cost of unskilled labour will range from the reservation wage in off-season to the full market wage at harvest and perhaps planting time. *In practice*, if better information is lacking, the shadow wage of rural labour in slack seasons may be taken as roughly the equivalent of 3 kilograms of grain per day, as mentioned above.

The cost of transforming a rural worker into an urban worker is the social cost of migration, which may be greater than the cost of providing only the additional housing, electricity, water, hospitals, schools and other social services required by the migrant who takes the job. The work of Harris and Todaro<sup>64</sup> indicates that more than one person may migrate to the city for each person who finds a job. The extra cost of providing social services for all these migrants, not just for the employed person, should be considered part of the marginal economic cost of producing an additional man-year of labour in the urban area.

The cost of transforming an unskilled worker into a skilled worker, or in more general terms, of employing a worker with lower skills in a job requiring higher skills, is the cost of training. When this cost is borne by society in the form of education available to all workers, not just those going to work for the project, it can be ignored for all practical purposes. When the cost of training is borne by the project, the cost will automatically be counted as part of project costs, and the benefits will be captured by the project in the form of higher worker productivity as long as the worker is still employed in the project. However, once the worker leaves, the training becomes an externality whose benefit is captured outside the project. In theory, the cost of training and thus implicitly the wage rate should be reduced by the net present value of the additional productivity of the worker from the time he leaves the job until retirement. *In practice*, it may be reasonable to ignore this externality, particularly if the project can expect to obtain similarly skilled workers who were trained elsewhere in the economy.

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<sup>63</sup> Workers may also be induced to work for less than their normal reservation wage if they are threatened with dislocation or, if in a barter, subsistence economy, they are required to pay a tax in money.

<sup>64</sup> J. B. Harris and N. P. Todaro, "Migration, unemployment and development: A two-sector analysis", *American Economic Review*, vol. 60, No. 1 (March 1970), pp. 126-142.

The third type of impact, inducing the importation of foreign workers, is not dealt with in any detail in the *Guidelines*. This effect is likely to be significant, however, if the project requires skilled workers, technicians, or managers not available domestically. The basic shadow wage for such labour is relatively easy to calculate; it is the wage they command. However, at the end of stage two, a premium should be added to project costs for the extra economic value of the foreign exchange these workers save from their wages and send out of the country.

The existence of owner-operators presents a particular problem in the economic analysis of projects, for their labour input does not appear in the financial statements; they receive their "wages" out of the profits of the operation. In such instances, an economic adjustment should be made to the financial cost of labour to reflect the shadow wage of a worker who could perform the same labour functions as the owner-operator. The entrepreneurial part of his contribution cannot be given a shadow price, for there is no reasonable way to set an opportunity cost on such a diverse input. It is sufficient to assume that profits are the reward for entrepreneurship and that the profits of the project in economic terms, after all factors have been paid their economic cost, are the shadow wage for entrepreneurship.

Summing up, the shadow wage rate can be determined in a manner directly analogous to that used for other inputs; the impact may fall on other employers, on the "production" of labour, or on its import. In concluding, it should be noted that the additional consumption of foreign exchange out of additional earnings because of the project or changes induced in consumption patterns by the project should be included as one of the economic costs of employing labour. The *Guidelines* does not deal with this point explicitly, but such a procedure can easily be followed in this *Guide* in the context of the adjustment for the foreign exchange premium at the end of stage two. By using the data on incremental income distribution to consumers and workers developed in stage three and estimating the percentage of tradable contents in this incremental income, the impact is determined. It is weighted by the premium on foreign exchange and added as a cost along with the project's other foreign exchange impacts.

### *Capital inputs*

The capital costs of a project can usefully be viewed from two perspectives for shadow pricing. For lack of better terms, let us call them the asset and the rent components. When Rs 100,000 is invested in project X, for example, two things happen. First, Rs 100,000 of financial resources is converted into real physical assets. Secondly, the investor removes this Rs 100,000 worth of financial resources from the national pool of savings that might be used for investment in alternative projects. Once invested in project X, therefore, these assets should yield a benefit, or rent, at least equal to what they would have otherwise earned.

The shadow pricing of capital thus presents two problems: (a) how to measure the value of the physical assets *per se*; and (b) how to measure the rental value or opportunity cost of capital—the benefits forgone by freezing investable resources as assets in project X instead of using them somewhere else.

Pricing of the asset component is exactly the same as for any other resource. If it is a fully traded good, the value is its border price. If it is partially traded or



non-traded, its shadow price is its economic cost of production if the project induces increased domestic production, or its economic value measured in terms of consumer willingness to pay if the project takes it away from alternative users. The labour involved in the construction of the physical facilities is likewise valued according to the guidelines laid out above. In each case, the adjustment factor is calculated, and an appropriate economic adjustment is added to or subtracted from the net present values of the capital investments at market prices that were entered in section 1.2.2 of the cash-flow table (table 2) in stage one. *In practice*, capital costs with roughly similar adjustment factors can be grouped together to minimize the work.<sup>65</sup>

The second part of the capital cost, its rent component, is the opportunity cost, or forgone productivity of the capital in other uses. The analysis here is strictly parallel to that for other resources:

(a) The economic cost of capital is the cost of generating capital resources through additional savings;

(b) Its economic value is the value of additional production in alternative uses.

To the extent that capital for the project is generated from additional savings, its economic cost is the price or rent savers must be paid to forgo an additional unit of present consumption, the consumption rate of interest (CRI). To the extent that the capital is taken away from competing investments, its economic value is its marginal product at shadow prices in the "marginal investment",<sup>66</sup> the investment rate of interest.<sup>67</sup> *In practice*, it is not necessary in the *Guidelines* to figure out where the capital came from, and thus the blend of interest rates that should be used, because stage three in this *Guide* converts the value of all inputs and outputs into their "consumption equivalents". It is therefore sufficient to use the CRI as the discount rate.<sup>68</sup>

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<sup>65</sup> Some authors argue that if capital for a project comes from abroad and is available only to the project, the assets purchased with these funds should not be recorded as a cost until the capital is repatriated. This argument assumes that, in the case of a mineral-exploitation project, for example, the foreign mining company would not have invested in the country in the absence of the project, and therefore no other investment or production is given up in order to use the capital for the mining project. Under such circumstances, the country would incur a real capital cost only when it had to repay the foreign firm's original investment. This approach tends to increase the net present value and rate of return on projects because at least part of the total investment cost is discounted over more years than if it had been counted as a cost at the time of actual investment. While this treatment is theoretically correct, there are few instances of projects subject to economic evaluation by national authorities in which it can truly be said that the capital would not otherwise be available to the economy. Thus, *in practice* capital costs should usually be counted at the time the physical investment is made. The most likely exception to the latter is a project involving a private foreign investor who would not invest in the country in the absence of the project.

<sup>66</sup> The marginal investment is the last that would be undertaken if all possible investments were ranked according to their economic profitability and available funds were distributed accordingly.

<sup>67</sup> If savings are more valuable than consumption (see stage three), the investment rate of interest theoretically should be further adjusted for the additional value to the economy of the part of the product that will be saved and will thus produce further rounds of additional consumption and investment.

<sup>68</sup> This discussion, an extension of that in the original *Guidelines*, was suggested to me by Stephen A. Marglin.

There are serious problems related to determining the CRI empirically.<sup>69</sup> *In practice*, however, two approaches can simplify the task considerably. The first is to use the “accounting rate of interest” or opportunity cost of capital as a crude first estimate of the CRI. The second is to treat the discount rate as a budgetary device rather than as an economic reality that can be verified empirically: if the first estimate of the discount rate indicates that more projects are “acceptable” than can be financed with the available funds, the discount rate should be raised. Conversely, if the investment implied by the “acceptable” projects (including investing the money abroad) leaves excess investment funds, the cut-off point for the discount rate should be lowered.

Because of the problem of determining empirically an appropriate CRI, the *Guidelines* recommends treating it as an unknown to be determined later as a “switching value”, that is, the value at which a project becomes acceptable. The graphical approach outlined above is very useful in this connection, for a switching value for one project is the value of the CRI that leaves a zero net present value for the project; it is the discount rate at which the net present value switches from positive to negative. Therefore, the switching value can also be regarded as the internal rate of return of the project. When more than one project is being considered, the switching value of the CRI is the discount rate at which one alternative comes to have a higher net present value than the other, a point also widely known as the cross-over discount rate. Another major practical advantage of the graphical approach in this connection is that the discount rate can be selected after the discounting is completed, provided, of course, that the rate chosen lies between 0 per cent and the upper “plotting point” discount rate.

These concepts can be demonstrated with figure III, which plots the net present economic values of projects A and B against discount rates of up to 25 per cent. If project A is considered in isolation, its switching value is 14 per cent, the maximum discount rate at which A is acceptable. Whether 14 per cent is the CRI is unknown, as indicated above, but the *Guidelines* suggests determining that by what it calls the “bottom-up” procedure. The project analyst “at the bottom” can prepare the project appraisal indicating that the internal rate of return is 14 per cent and present it to the ministers or planners “at the top”.

If the ministers or planners accept the project, the analysts can assume that the planners judge the CRI to be less than 14 per cent; if they reject the project on the basis of the rate of return, the analysts know that the CRI is higher than 14 per cent. A repetition of this process, provided that the planners at the top are consistent, will gradually narrow the estimated CRI in the country to an acceptable range.

If projects A and B in figure III are both under consideration as mutually exclusive alternatives, and if the planners choose project A, the analysts can assume that the CRI is less than 11 per cent, for at discount rates higher than this switching

<sup>69</sup> A theoretical formula exists for calculating the CRI:

$$\text{CRI} = ng + p$$

where:

$n$  = elasticity of marginal utility of consumption with respect to changes in *per capita* income;

$g$  = annual growth of average *per capita* income; and

$p$  = pure time preference.

*In practice*, because of the inherently subjective nature of  $n$  and  $p$ , it makes more sense to follow the “bottom-up” approach suggested in the *Guidelines*: there is little point in having two areas of subjective judgement instead of one.

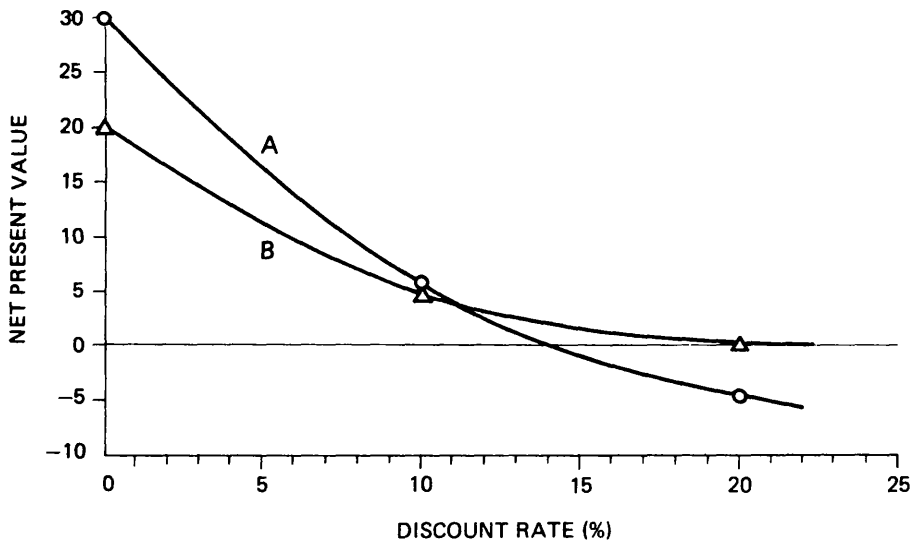


Figure III. Switching values

value the net present value of project B becomes more attractive. The converse conclusion is reached if project B is preferred by the ministers or planners, and again the actual value can be narrowed down by repetition of the process.<sup>70</sup>

#### Application of the shadow prices

There is still one more efficiency shadow price to be applied before stage two is completed, the shadow price for foreign exchange. However, as the adjustment factors for foreign exchange must be applied to the economic rather than to the market values of inputs and outputs, the adjustment factors developed to this point must first be used to modify the net present financial values developed in stage one. It would probably be counterproductive to develop a full case study here on the derivation of economic shadow price adjustment factors for one particular project; the process would be tedious, and the results limited to a particular situation. Table 10 shows, however, how a set of hypothetical adjustment factors based on assumptions given at the bottom of the table can be applied to the net present financial data from the example developed in the standard financial tables of stage one to derive the net present value of the project in economic terms as well as the market-price distortions that affect financial transactions and thus the distribution of income.

<sup>70</sup>The importance of a reasonably good specification of the CRI is demonstrated in figure III. On the basis of a pure internal rate of return, project B would be chosen (20 per cent). However, if the CRI were actually 5 per cent or even 10 per cent, project A clearly would be preferred because of its higher net present value. For example, if faced with a choice between a thermal and a hydro generating plant, a slow-growing or capital-abundant country with a low discount rate would tend to opt for a hydro plant (e.g. alternative A) despite the higher internal rate of return of the thermal plant (e.g. alternative B) because of the higher net present value of the hydro plant at the relevant discount rate (e.g. 8 per cent).

*Net cash flows—real*

The values under the “financial net present value” columns in table 10 for both the real (physical) and financial cash-flow sections are taken directly from the financial income statement (table 1) and the financial cash-flow statement (table 2). The only values that need to be brought forward, however, are those requiring adjustment. (This adjustment, of course, includes the total real net cash-flow line, which must be adjusted to reflect economic values.) Under the heading “adjustment to cash flows”, the first column gives the adjustment factor (AF) for each row. These factors should be developed on the basis of the shadow-pricing principles of this chapter. The present value of each input and output at the three discount rates is multiplied by these factors to obtain the positive or negative adjustment value (AV). The AV for each line and discount rate is then added to the respective financial net present value to obtain the preliminary economic present value for the respective inputs and outputs. (The value is preliminary because the foreign exchange impact has not yet been considered.) This set of columns reflecting economic values of individual items is optional, since the adjustment of the net cash flow can be calculated directly from the economic adjustment columns, but it is useful to have the individually adjusted economic present values for calculating the foreign exchange adjustment discussed at the end of this chapter.

The net present economic value of the project at each discount rate is obtained by adding up the AVs in the net cash flows—real section at each discount rate (minding the signs and whether the individual item is a cost or a benefit), then adding (negatively in this case) the net adjustment, which appears in the bottom row of these columns, to the financial net present values.

The financial and preliminary economic net present values may then be plotted as in figure IV to obtain the respective net-present-value curves. The preliminary economic curve shows that if there had been no premium on foreign exchange, a

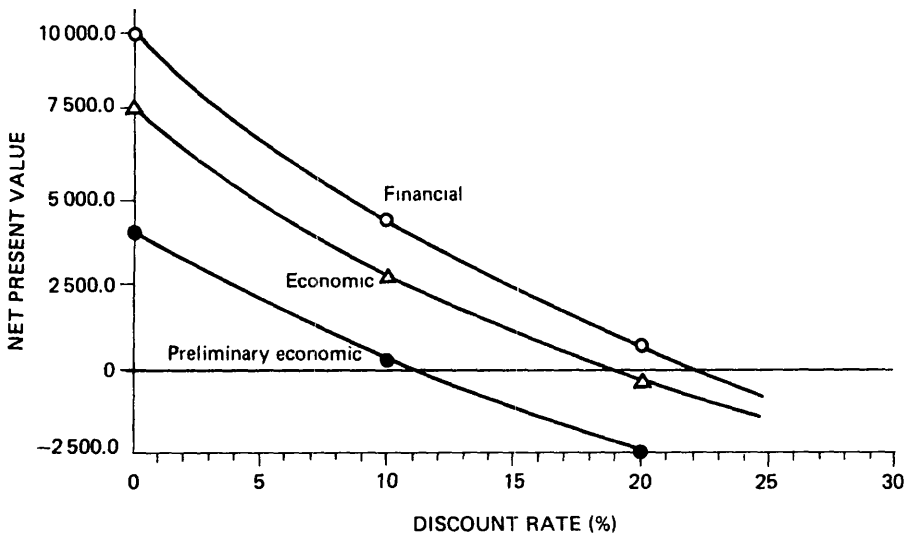


Figure IV. Financial and economic present-value curves

premium reflected later in the economic curve, the economic internal rate of return would be only 11 per cent compared with the financial rate of return of 22 per cent. At the risk of jumping ahead a bit, it may be noted that the economic rate of return after the foreign exchange adjustment has been made is substantially higher (19 per cent) because the project produces efficiently an importable product using a minimum of tradable inputs in an environment where there is a significant (10 per cent) premium on foreign exchange.

#### *Net cash flows—financial*

The method followed in the lower portion of table 10 is similar to that used in the upper portion, where cash flows associated with physical inputs for production and sales of output have been adjusted to account for distortions in market prices. In the financial cash-flow section, however, the emphasis is on such distortions with respect to value received by the firm rather than by the economy. The purpose of this section, since it deals with financial rather than real resources, is to measure the project's impact on the income received by various groups rather than on the efficient use of economic resources. Perhaps the easiest way to explain what is meant by distortions between the market prices and the value received by the firm is to examine the three examples presented in table 10.

It is assumed that the firm receives a loan from the government at a concessional lending rate, which results, in terms of net present values at a 10 per cent discount rate, for example, in the firm's paying only 75 per cent of the interest it would have paid at the opportunity cost of capital. Since the interest paid would have to be increased by 35 per cent to equal the real value of the funds borrowed (75 per cent  $\times$   $(1.0 + 0.35 = 100$  per cent), we can say that at a 10 per cent discount rate, the firm enjoyed an "extra" income of 398.<sup>71</sup> Note that this extra income is due solely to the financial arrangements made by the project and has nothing to do with its efficiency of production; for this reason this matter is considered separately from the cash flows in the first part of table 10 related to physical resources.

The second example of an adjustment in financial cash flows in table 10 relates to the taxes paid by the project to the government. Since these taxes have no direct value to the firm, the adjustment factor is a minus 100 per cent; this income is completely lost to the firm for all intents and purposes.<sup>72</sup>

The payment of dividends abroad is the third example of an adjustment in financial cash flows that is needed to reflect the value of income received by the firm. Here it is assumed that the investors hold only a portfolio interest in the firm and as such are regarded by the firm as external agents whose welfare means little, at

<sup>71</sup> See chapter IV for a discussion of the way to calculate the present value of the subsidy implicit in a concessional lending rate.

<sup>72</sup> The omission of the fact that the project benefits both directly and indirectly from government expenditures on roads, schools etc., which are made possible by tax revenue, is justified on three grounds. First, in conformity with its orientation towards practical applicability rather than theoretical purity, this *Guide* generally ignores second-round effects (if you consider second-round effects, why not third, fourth?). Secondly, in large part all firms benefit more or less equally from most government expenditures; taking these factors into consideration would needlessly complicate the calculations without changing the decisions. Thirdly, "taxes" that are directly related to specific services received are not included in this section anyway; they are included as operating expenses.

least as far as the firm's immediate income calculations are concerned. Therefore, the dividends paid out are just as much a "loss" to the firm as are taxes paid to the government. Consequently, an adjustment factor of -100 per cent is applied. (The foreign exchange implications of these dividend payments is examined in connection with table 11.)

### Foreign exchange

Since the UNIDO method uses domestic currency as the *numéraire*, the project's foreign exchange impact must be identified so that the project's net present economic value may be adjusted by an appropriate premium, assuming of course that foreign exchange is more valuable than indicated by the exchange rate.<sup>73</sup> This process increases those economic-efficiency values that were measured in border rupees (border prices in dollars multiplied by the market exchange rate) by the percentage premium on foreign exchange, a factor that roughly indicates the level of protection in the economy, i.e. the difference between average market and average border prices.<sup>74</sup> This adjustment makes the prices established with reference to border prices compatible with prices based on domestic consumer willingness to pay in the protected market.<sup>75</sup> If the foreign exchange impact is positive, the net present value before adjustment will be increased by the adjustment; conversely, if it is negative, the net present value will be reduced.

In principle, all inputs and outputs are either tradables that can be valued directly in terms of foreign exchange or non-tradables whose inputs can be disaggregated in terms of tradables, non-tradables and labour. If the non-tradables identified in the first round of disaggregation are further disaggregated in a similar manner, and so on, theoretically any non-tradable can be valued in terms of its foreign exchange, domestic labour and capital content. Thus, it is impossible to say that the project analyst should count only the direct foreign exchange impact of the project in this part of the UNIDO analysis; the line between direct and indirect is too arbitrary to be of any help to the analyst.<sup>76</sup>

<sup>73</sup> Foreign exchange may, of course, be less valuable than indicated by the market exchange rate, a situation that might prevail in a relatively open economy that had just undertaken a major (and essential) devaluation. In this case, the adjustment factor would simply assume a negative value. *In practice*, however, in most least developed countries that are not oil producers, it is generally safe to assume that there will be a premium on foreign exchange.

<sup>74</sup> The determination of the foreign exchange premium or adjustment factor is taken up at the end of this section. The average approach suggested here is at variance with the marginal approach of the *Guidelines* but is much easier to use and is less likely to produce nonsensical conclusions because of faulty data; marginal rates can become extremely sensitive.

<sup>75</sup> In the Little-Mirrlees system, a reverse but equivalent approach is used. Instead of increasing border prices to the domestic-market level with the premium on foreign exchange, domestic prices are decreased to border-price levels by the standard conversion factor.

<sup>76</sup> The *Guidelines* implicitly makes a distinction between direct and indirect foreign exchange impacts: "If . . . resources include foreign exchange—via directly imported inputs, via exportables, or via import substitutes—then to that extent the relevant net input consists of foreign exchange" (p. 58). For the reasons given above, however, this implicit distinction has been challenged by readers of earlier drafts of this *Guide*, which used this distinction, and has therefore been dropped from the present version. I am particularly indebted to Maurice Scott for raising this important point (see his "How to use and estimate shadow exchange rates", *Oxford Economic Papers*, vol. 26, No. 2 (July 1974), pp. 69-70).

*In practice*, the foreign exchange premium needs to be applied only to those goods that were valued at border prices, since inputs and outputs shadow priced with reference to domestic consumer willingness to pay or cost of production already implicitly include a premium on foreign exchange. Goods shadow priced “at the border” would generally include (a) all major inputs and outputs; and (b) any major non-traded inputs with a substantial foreign exchange component (e.g. electricity produced from imported oil).

Once an appropriate decision has been made about the inputs and outputs for which the foreign exchange impact will be evaluated, these impacts must be quantified separately for each input or output category so that an adjustment can be made to the net present economic value of the project given in table 10. Whether this adjustment is done on year-by-year values or on present values as recommended above depends on the assumption made about (a) the shadow price for foreign exchange over time; and (b) the foreign exchange content over time.

*In practice*, it may not be unreasonable to assume that both of these values are constant. The first assumption is widely made; few writings recommend that this value be changed over time, for there is usually little evidence to guide such differential shadow pricing of foreign exchange.<sup>77</sup> The second assumption is open to more challenge, but generally is reasonable. Even if there is a reduction in the direct foreign exchange content of a major non-tradable input (e.g. electricity now produced from oil that later will be replaced by indigenous hydroelectric power), the hydro facility will almost certainly involve some direct or indirect foreign exchange expenditures. The assumption of constant foreign exchange content for any specific input or output is especially reasonable in agricultural and industrial projects, where, aside from labour, the inputs and outputs are generally tradable.

Without these assumptions, it is necessary to calculate the foreign exchange impact of each input and output in each year of the project, calculate the premium, discount it back to the present to obtain a net present economic adjustment value of the foreign exchange impact and add it to the basic net present economic value.<sup>78</sup> The use of these assumptions greatly simplifies the valuation of the foreign exchange impact in the UNIDO method, for then this impact can be calculated on the basis of net present economic values. The present value of each input and output is multiplied by a weighted adjustment factor to obtain its foreign exchange adjustment value. These adjustment values are then added up as was done with the economic adjustment in table 10 and used to modify the respective net present values

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<sup>77</sup> If there is strong evidence, however, that a given country is moving purposefully towards a free-trade policy, the precision of the analysis could (perhaps usefully) be increased by estimating the years until free trade is reached, then reducing the premium on foreign exchange each year by the present premium divided by the number of years to free trade. Conversely, if a country has recently undergone a substantial devaluation so that there is currently little or no economic premium over the official rate for foreign exchange, but if it is expected that fundamental problems will make another devaluation necessary in the near future (not an uncommon situation), it may be reasonable to apply a gradually rising premium. More refined non-linear estimations would probably be pointless given the uncertainties surrounding international trade and trade policies. *In practice*, it may be sufficient to set up a limited number of periods and hold the premium consistent during each period, which would simplify the calculations.

<sup>78</sup> If the year-by-year adjustments are to be made, it would be advisable to set up the financial income statement and/or financial cash-flow table for the commercial-profitability analysis in stage one so that there is a double column under each year, one for the basic price and one for the foreign exchange content of this price

(table 11). The weighted adjustment factors are the product of the foreign exchange content of each item and the adjustment factor for foreign exchange. All the year-by-year computations are thus avoided.

The premium to be attached to foreign exchange is important. (Note in figure V for example, that the rate of return with the adjustment is 19 per cent compared with 11 per cent without the foreign exchange adjustment, even though the premium is only a relatively modest 10 per cent.) The *Guidelines* uses a foreign exchange shadow price based on marginal social value as revealed by the consumer willingness to pay for it in the form of imported goods. Without going into details, the derivation is based on the average of the percentage by which the domestic market price of the last unit of each good imported by the country exceeds its c.i.f. price expressed in domestic currency weighted by the share of each good in the actual marginal import bill.<sup>79</sup> Assuming a freely competitive domestic market for the good, this approach to valuing foreign exchange implicitly uses the domestic willingness to pay a premium above the "official" price for the foreign exchange needed to purchase these goods. If it can be assumed that the average premium on foreign exchange with an increase in economic activity will remain about the same, an adjustment factor based on a formula for average shadow exchange rates will be approximately equal to one based on a formula for a marginal shadow exchange rate.

*In practice*, the approach outlined in the preceding paragraph should give a usable estimate of the shadow price of foreign exchange. If the data are available, however, a more accurate indication of the shadow price of foreign exchange can be obtained. The approach proposed in the *Guidelines* is, as indicated above, based on the assumption that, in the case of a project that is a net user of foreign exchange, the amount it uses may be taken from other users and thus falls under the shadow pricing category of "consumer willingness to pay".<sup>80</sup> However, the use of foreign exchange by the project may also encourage the "production" of foreign exchange through manufacture for export or import substitution, in which case a somewhat different approach is required. This "production" will be stimulated if demand for foreign exchange by the project changes the incentive to other potential producers of export or import substitutes. The incentive to undertake foreign exchange earnings or saving activities depends on the "effective price" of foreign exchange, the "rupee" benefit received by domestic producers of goods who, on balance, earn or save a dollar of foreign exchange. For example, if the official exchange rate is Rs 10/\$1, the c.i.f. price of an import-substituting good is \$3 and the domestic manufacturer, because of protection, can charge Rs 45, the "effective" rate is Rs 45/\$3, or Rs 15/\$1. This incentive will remain unchanged only if the effective foreign exchange price remains constant. If the effective rate does remain constant, the demand for

<sup>79</sup> A simple formula for calculating an average shadow exchange rate (SER) similar to the UNIDO approach and based on a given year's data is:

$$SER = OER \left[ \frac{(M + T_i) + (X + S_x)}{M + X} \right]$$

where OER = official exchange rate; M = c.i.f. value of imports; X = f.o.b. value of exports;  $T_i$  = import tax revenues; and  $S_x$  = export subsidies. (Export taxes should be regarded as negative subsidies.) Where quantitative restrictions are important, their tariff equivalents should be included, and if there are other sources of difference between border and domestic ex works prices (e.g. transport costs and importing profits), these should also be considered. Furthermore, any prohibitive quantitative restrictions or tariffs should be taken into account as well, if feasible.

<sup>80</sup> The converse of the following applies to projects that are net producers of foreign exchange.



foreign exchange by the project would fall on other users, for there would be no inducement to the new production of foreign exchange, and all would have to share the present supply. The effective price is, however, very unlikely to remain constant, for that would require much more than a stable official exchange rate. It would require that there be no change in tariffs, quantitative restrictions, capital-movement regulations or any other protective device, despite increased demand for foreign exchange by the project and by other users. Such a situation would almost never occur, except in the short term, for it would deplete the country's foreign exchange reserves, which few governments could allow for long. Instead, given an increased demand for foreign exchange, the government would, for example, devalue the domestic currency, increase trade restrictions or increase export subsidies, which in turn would increase the incentives to produce import substitutes and exportables to earn foreign exchange and would reduce the incentives to produce non-tradables.

Given these predictable impacts of an increased demand for foreign exchange, it becomes important to examine the cost of producing additional foreign exchange and the value of such to the users. The relative importance of these two aspects—cost and supply and value and use—will depend, of course, on the relative responses of the supply and demand for foreign exchange given changes in its effective price.

Probably the best known approach to determining the cost of producing foreign exchange is the domestic resource cost method proposed by Michael Bruno.<sup>81</sup> While this approach is oriented to the cost of producing foreign exchange by a single project, the same principles apply at the macro level. However, at the macro level the analysis becomes more complex in that the elasticities of alternative sources of foreign exchange and of the demand for imports become important. Examination of this aspect of the shadow price of foreign exchange<sup>82</sup> would be a logical extension of the UNIDO method, although *in practice* it is unlikely to have a major impact on the relative ranking of projects.

Once the shadow price of foreign exchange has been determined, the adjustment factor for foreign exchange ( $AF_f$ ) should be calculated. It is the premium on foreign exchange over the market rate and is equal to the shadow exchange rate divided by the market exchange rate, minus one. For example, if the market rate vis-à-vis the dollar is Rs 23 and the shadow rate is Rs 20, the  $AF_f$  is  $23/20 - 1$ , or 15 per cent. The  $AF_f$  is weighted by the foreign exchange content of each item, and the weighted  $AF_f$  is used to determine the foreign exchange adjustment, which is then added up and used to adjust the economic net present value as discussed above. The adjustment for the value of foreign exchange puts the shadow prices fully on the basis of domestic accounting rupees.

<sup>81</sup> Michael Bruno, "Domestic resource costs and effective protection: Clarification and synthesis", *Journal of Political Economy*, vol. 80, No. 1 (January/February 1972), pp. 16-33.

<sup>82</sup> See Bela Balassa, "Estimating the shadow price of foreign exchange in project appraisal", *Oxford Economic Papers*, vol. 26, No. 2 (July 1974), pp. 147-168. Balassa's formula for the premium on foreign exchange in a situation where trade restrictions are expected to continue (his second-best shadow exchange rate) as given on page 163 is (implicitly):

$$AF_f = \frac{\sum_i e_f X_i (1 + S) + \sum_i n_m M_i (1 + T)}{\sum_i e_f X_i + \sum_i n_m M_i} - 1$$

where  $AF_f$  = adjustment factor for foreign exchange;  $e_f$  = elasticity of supply of foreign exchange;  $n_m$  = elasticity of demand for imports;  $X_i$  = exports;  $M_i$  = imports;  $T$  = import taxes and  $S$  = export subsidies.

The foreign exchange adjustment factor is next used in the second half of table 11 to adjust the financial cash flows to reflect the differences between what the project paid for foreign exchange used in financial transactions and what the foreign exchange is really worth. Similar adjustments are made with respect to foreign exchange the project received and the value of what it gave out in return.

The equity and dividend entries in table 11 demonstrate both of these points. The project sold 7,000 of equity stock, of which 40 per cent was sold abroad for foreign currency. However, since the domestic currency was overvalued, the foreign investors received less stock at the market price than their foreign currency was worth. As will be seen in the next chapter, the result is an income gain for the project and a loss for the foreign investors. The payment of dividends works conversely. The project must pay dividends abroad in foreign exchange it purchases from the government at an overvalued exchange rate. Consequently, the "true" value of the dividend payments, as far as foreign exchange is concerned, must be increased appropriately, as shown in table 11.<sup>83</sup>

### Economic acceptability and the consumption rate of interest

Once the economic net present values have been calculated at each discount rate in terms of domestic accounting rupees (e.g. the values 7,755, 3,079 and -205 in line 1.0 of table 11), these values should be plotted as in figure V. (Note that, especially in situations where the foreign exchange adjustment is significant, the preliminary net present values calculated before the foreign exchange adjustment are meaningless and should be ignored because they represent a mixture of values with different *numéraires*. Those based on border prices are in border rupees, while those based on domestic willingness to pay or cost of production are in domestic accounting rupees. They are shown here only to emphasize the impact the foreign exchange adjustment factor can have on the rate of return.)

In the sample project used in this *Guide*, the economic net present value is positive at almost any reasonable discount rate, and the project would be acceptable. If, however, the project were in a country where there was no distortion in the price of foreign exchange, the preliminary economic curve in figure V would be relevant, and the choice of a discount rate would be an issue, since the rate of return is only 11 per cent.

The discount rate in the UNIDO method is the CRI because all values have been converted to their consumption equivalent by the end of stage two. However, as noted earlier, since the CRI cannot be measured empirically, the *Guidelines* suggests that it be determined from the bottom up on the basis of switching values. This method is satisfactory, provided that the analyst can present meaningful alternatives where the rate of return is the only variable that will influence the politicians' or planners' decisions. *In practice*, many factors will influence the choice, and the decision makers themselves may change over time. Since this could lead to confusion

<sup>83</sup> It should be noted that the adjustments in the lower portion of table 11 are made with respect to market prices paid or received rather than to the adjusted preliminary value because, in contrast to the economic evaluation, the focus here is on distortions between market prices and value received by the individual rather than that between market prices and value to the economy as a whole. Thus, the foreign exchange adjustment on dividends is applied not to the zero preliminary economic value retained by the project, but rather to the 900 (at zero per cent) paid out by the project.

for analysts, who will need some rough guidance at the outset in their design of projects, it is suggested in this *Guide* that, at least as a starting point, the planners give the analysts “from the top down” an estimated value for the CRI. While the estimate may be influenced by the equation for the CRI on page 42 n, *in practice*, the planners would not go far wrong as a tentative first step to try a discount rate of 10 per cent.

If the CRI is estimated at 10 per cent and there are no foreign exchange distortions (i.e. if the preliminary economic curve in figure V is the relevant curve), the project is acceptable, but only barely acceptable, for the net present value is negative at discount rates greater than 11 per cent. This example points out, incidentally, the ease with which sensitivity analysis can be performed if the graphical approach recommended in this *Guide* is followed.

Three categories of countries present special problems in connection with the application of an “appropriate” cut-off discount rate because available projects with a rate of return at least equal to the rate that could be earned by lending the money abroad would not exhaust the available funds. This “absorption” problem is particularly likely to arise in:

The least developed countries

Countries whose development is progressing but lack sufficient capabilities for identifying and preparing good investment projects

The capital-surplus, oil-producing countries

If the low rates of return on projects result from the lack of adequate infrastructure, and if infrastructure projects show low rates of return because of the difficulty of measuring the benefits such investments will have in terms of the new economic activity they will make possible, the decision makers should probably proceed with the infrastructure projects to establish the base for future growth. But, if the main problem is a lack of capabilities for identifying and implementing projects, funds should be invested in developing (or hiring) this expertise, and any funds that cannot be invested domestically to yield at least the rate on international markets should be invested abroad until the country’s absorption capacity has improved.

Stage two of the UNIDO analysis is finished once the project’s acceptability in terms of economic efficiency has been determined. The results of stage two will later be recorded in the project summary matrix, and the present values will be plotted in the project summary graph to facilitate comparison of the results of this and the other analytical stages (see chapter IX).

## V. MEASUREMENT OF THE DISTRIBUTION IMPACT

This chapter is a necessary technical digression before stages three and four of the UNIDO method, the stages dealing with the value of the project's impact on savings and investment and that on income distribution.<sup>84</sup> In these stages values will be placed on these impacts so that the economic net present value calculated in stage two can be adjusted accordingly. First, however, the magnitude of these impacts must be measured. To facilitate such measurement, an income-flow-analysis table (table 12) has been designed. The method proposed may not be the most sophisticated, but it seems to be a reasonable compromise between what would be desirable in terms of economic theory and what is practical.

### General concepts

#### *Measurement*

The additional income gained or lost by individual groups within the society because of the project must be measured. These gains and losses are assumed here to be equal to the distortion between shadow and market payments to each input or output in the case of physical resources or the distortion between price paid and value received in the case of financial transactions. For example, if (a) the shadow wage rate is Rs 6 per day; (b) the market wage is Rs 10; and (c) in the absence of the project, labour would probably have received only its Rs 6 per day shadow wage, the distortion between shadow and market wages of Rs 4 is the impact of the project on the income of such labour.

*In practice*, it is probably reasonable to assume that this means of calculating the distributional effect of a project on the income of wage earners is legitimate. Although the person hired by the project may have been employed previously at the same distorted market wage, if the shadow wage rate was based on the assumption that at the margin a person would be taken from the pool of the unemployed, another person somewhere in the economy will become employed and enjoy this additional income due to the distorted market wage.

If there is strong reason to assume that for certain inputs and outputs existing distortions would simply be continued with no net effect on the income flows, the analysis should be done on an incremental with-and-without basis. The income flows would then be the difference between the two situations. For example, if a project

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<sup>84</sup> In reality, both of these impacts affect the distribution of income, the former affecting the distribution of income over time (one generation saving so that the next can consume), and the latter affecting the distribution of income at any given time among contemporaries. Consequently, these are often called, respectively, intertemporal and intratemporal income-distribution impacts. In this book, however, they will be referred to as the impact on savings and the impact on income distribution.

using steel will drive a less efficient fabricator out of business, but will continue to buy the same amount of inefficiently produced domestic steel from the same local steel mill, there is no new income flow vis-à-vis the local steel producer despite the difference between the shadow and market prices for the steel. However, if the shadow prices chosen in stage two were chosen well, in those instances in which, either directly or indirectly, the additional (marginal) worker, for example, is already fully employed in efficient production, the shadow price will probably equal the market price, and no distortionary income flows would be indicated anyway.

### Groups

The groups that lose and gain income because of the project may be defined in many ways. Theoretically a different weight should be applied to each level of income. Furthermore, distinctions should usually be made between government and private, rural and urban, and local and foreign, and often even within these groups. For example, the allocation of benefits between small and big businessmen may be more significant than their division between businessmen and the external sector. The same is true for small and large farmers. *In practice*, income-distribution analysis is often limited to two groups: the poor, whatever their occupation, and everyone else. The example in this chapter takes a slightly more disaggregated approach, however, indicating in table 12 gains and losses by the:

- Project
- Other private business
- Government
- Workers
- Consumers
- External sector

Many other equally valid groupings are possible, depending on the degree of sophistication desired in the analysis. It should be apparent that the project in this example is assumed to be privately owned; however, the same method of measuring income flow works equally well regardless of the project's ownership. If, for example, the project is in the public sector, the weights on income going to the project will be adjusted accordingly, and in table 12, transfers to the government may be recorded in line 2.2.3 as dividends. Likewise, although the present example assumes that the dividends are paid to foreign owners, the table would work equally well were they to be paid, for example, to workers in a co-operative as their share of profits.

If a project will have a significant impact on the relative<sup>8 5</sup> income level of a group over time so that the premium attached to income enjoyed by this group will change, it may be desirable to set up two subgroups, allocating income early in the project's life to the first group when the beneficiaries are still relatively poor, and to the second later on when they become relatively better off. This procedure may be of particular importance in rural development projects, which often bring about a significant improvement in the standard of living of the participants.

<sup>8 5</sup> If the income of all groups rises proportionately over time, this issue will probably not arise, since the weights are based on relative rather than absolute income levels.

*Losses balance gains*

A fundamental assumption made in the method presented here is that there is a gainer for every loser. If unskilled workers gain because the market wage exceeds the shadow wage, for example, the project loses because it has to pay more than the economic value of the workers. Similarly, if the consumers lose because they pay more for the tractor than its economic value, the project gains by a like amount. A further assumption is made that the project is a loser if the economic net present value of the project is distributed to others, for, without the project, the surplus would not have been generated.<sup>86</sup>

The assumption of gains balancing losses has an important practical implication; it means that double-entry bookkeeping can be used to keep track of the income flows. Each item must be entered twice in the income-flow statement (see table 12), once as a loss and once as a gain. In the end the analyst can easily check the consistency of his work; everything should sum to zero.

*Allocative versus redistributive impacts*

So far the emphasis has implicitly been on income flows resulting from an allocation of the economic net present value of the project. Another type of flow is entirely possible, however, the redistributive flow, one that takes away something another group already has rather than simply allocating something new.

Income transfers of this type from one group to another may be generated by two situations:

(a) Receipts. A resource is paid less than its economic value (e.g. capital is borrowed from the government at 4 per cent when the opportunity cost of capital is 10 per cent);

(b) Expenditures. A resource is purchased at more than its economic value (e.g. consumer pays Rs 2,000 for a refrigerator worth only Rs 1,000 at border prices).

Since there is a loss for every gain, there must be a redistributive loss corresponding to every redistributive gain (e.g. the government's loss when the project gains by paying only 4 per cent for its capital). A project may therefore generate income flows even though it has a zero or negative net present value.

*Project always involved*

It was pointed out earlier that the approach suggested here is less than theoretically perfect. Perhaps the major deficiency is that no account is taken of secondary flows; only first-round income flows in which the project is directly involved are considered. For example, the owners of a fertilizer project may earn substantial excess profits because of price distortions that permit them to charge the poor farmers "redistributive" prices for the fertilizer. Income is taken from the poor and given to the rich, which is "bad", but no account is taken of the fact that,

<sup>86</sup>The right of various factors of production such as workers and entrepreneurs to claim social surpluses is a deep philosophical and social issue that cannot be explored here.

despite its being overpriced, the fertilizer may markedly increase the income of the poor farmers.<sup>8 7</sup> In theory the analyst should consider such second-round effects, for conclusions reached on the basis of first-round effects may be misleading. *In practice*, however, it is often difficult to identify even the first-round distributive effects; thus, unless there is strong evidence that the second-round effects would reverse the ranking of projects based on first-round effects, analysis of the latter should be sufficient.

#### *Source of data*

Valuation in terms of the impact of a given set of income flows on savings and on income distribution depends on the social value of savings compared with that of consumption and the social value of income in the hands of different groups—two highly political criteria.

The measurement of these flows *per se* is, however, relatively straightforward, given the analytical structure developed in this *Guide*. As noted above, with the assumptions that have been made, all income flows generated by the project are the result of differences between the market and the economic prices of the physical inputs and outputs involved or between value paid and value received for financial resources. Since precisely these values were used in stage two to modify the market values in the financial cash-flow statements of stage one, the distributional analysis in this chapter can be based on these adjustments. (Where adjustments have not been made, the assumption is that the financial and efficiency value prices are the same; these transactions therefore do not generate any income flows and can be ignored.)

The data required for the income-flow analysis in this chapter thus comprise, for each input or output affected, the adjustment made to move from financial to preliminary adjusted prices (table 10) and that made to move from preliminary adjusted prices to prices adjusted for the foreign exchange impact (table 11).

#### *Tabular format*

The groups that gain and lose because of each distortion in the market prices can be identified easily with the help of an income-flow-analysis table such as table 12. This table, presented here for discussion showing only the top section with detailed values filled in at a 0 per cent rate of discount, provides columns for each of the target groups. The number of groups can vary, of course, depending on the desired sophistication of the analysis, as discussed earlier. The rows of the income-flow-analysis table follow the format used in the economic-adjustment tables. The basic data for the analysis, which come from tables 10 and 11 (the economic-adjustment and foreign-exchange-adjustment tables of stage two), are recorded in columns 1 and 2 of table 12.

Many items have been left blank or left off the list entirely (e.g. skilled labour, repairs etc.) because there is no difference between their market and shadow prices; consequently, there is no distortion to generate an incremental income-distribution flow.

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<sup>8 7</sup> This example is valid only if there is good reason to believe that over the life of the project government import policies will remain such that the farmers would not be able to get the fertilizer were it not for the project.

### Application of the method

Perhaps the easiest way of understanding the method proposed here for measuring income-distribution impacts is to follow step by step through an example. The example shown in table 12 is based on the same project reflected in the financial statements in stage one and in the economic-adjustment tables in stage two. All references apply to present values at a 0 per cent discount rate. The following sections describe the derivation of the data in each part of table 12 and comment on other related situations that may arise.

#### *Production*

The financial value of the production and sale of tractors, as shown in the economic-adjustment table (table 10), must be reduced by 15,800 to obtain the present economic value at border prices (line 1.1.1/1). This value is recorded as a gain for the project, which receives this additional amount, because of the protection on its output, and as a loss to the consumers, who must pay this premium over the border price of the tractor.<sup>88</sup> This adjustment overstates the loss to the consumers, however, for by purchasing the domestically produced tractor, they avoid paying directly (e.g. as an import tax) the premium on foreign exchange, which, as shown in table 12, would amount to 6,320 on these tractors. This 6,320 is recorded in the income-flow-analysis table as a gain to the consumers and a loss to the project, which is deprived of collecting the foreign exchange premium on this import substitute. This loss to the project, however, is more than outweighed by the gain it enjoyed from protection; the net gain to the project on this transaction is 9,480, the same as the consumers' net loss.

Although in this example the consumers lost by paying a higher price for the product after implementation of the project, the consumers could also gain. The most common case of an incremental income flow to consumers would involve a non-tradable good or a tradable good that is to be treated as a non-tradable because

<sup>88</sup> It is already clear that negative adjustments are not always a loss to the project (the converse is true for positive adjustments). It is very important to note whether the adjustment is made to an output or to an input. Projects gain from overstated market prices for their outputs and from understated prices for inputs; also, they gain by purchasing domestic materials without paying the foreign exchange premium and lose by selling goods for domestic currency because the purchaser is permitted to obtain the good without paying a foreign exchange premium. A negative adjustment in economic value is associated with a positive adjustment in the foreign exchange impact, since protection tends to lead to overvalued exchange rates. (If the economic and foreign exchange adjustment factors are the same, if the percentage protection enjoyed by the product corresponds to the percentage overvaluation of the local currency, these gains and losses will tend to cancel out.) The converse is true in each instance for groups other than the project. These counterbalancing interrelationships can become rather confusing as one tries to fill out table 12 allocating the price and foreign exchange adjustments to each group appropriately. The summary below may help keep the items straight. It is written in terms of the project, but once the sign for the adjustment to the project's income is determined, that for the corresponding losing or gaining groups will be obvious.

<u>Direction of adjustment</u>	<u>Project enjoys gain (+) or loss (-)</u>	
	<u>Output</u>	<u>Input</u>
-	+	-
+	-	+



of fixed protectionist trade policies. For example, bread and other bakery goods are generally non-tradable because they are perishable. Consequently, if a project were introduced that would produce the same quality bread for one third less or whose production would provide competition to an existing monopolist and thereby drive prices down, the reduction in the cost of the consumption good would be recorded as a gain to the consumers and, to the extent that other competitors had to lower their price, a loss to the other firms.

In this connection, it should be noted that the method proposed in this *Guide* permits the analyst to handle a related problem that is somewhat difficult. Assume, for example, that the new bakery would reduce the cost of bread sold mainly to the poor by employing capital-intensive techniques that would throw a substantial number of small bakers into unemployment. To determine the net impact of such a situation on national objectives, the analyst would record the reduction in cost of the bread to the poor as an income gain, the loss of income of the bakers displaced as an income loss and, if the consumers and bakers are in different income groups, weight the changes in income and compare the results. The same techniques could be applied to the classic problem of the impact on employment and the cost of wage goods that occurs when a modern plant begins to produce plastic sandals at a price that drives hundreds of small cobblers out of business.

In addition to marketed output, a project may also produce non-marketed output and externalities. In the present example these do not arise; but if the project had provided a non-marketed service such as housing to its workers at a 40 per cent subsidy, the amount of the subsidy would have been a loss to the project and a gain to the workers. Similarly, if the housing had been provided completely free of charge, strictly as an "extra", the value of equivalent accommodation would have been a gain to the workers and a loss to the project.<sup>89</sup>

Similarly, if the project produced smoke that polluted the atmosphere and caused a general loss of property values in the area, such an externality should be valued and accounted for. Most common acknowledged externalities like pollution actually affect the physical resources available in the economy and as such should first be accounted for in stage two as economic costs. By definition externalities are "external" to the financial accounts of the project; therefore the full present value of any externality will appear in the adjustment section of the economic-adjustment table (table 10) and thus in the income-flow table as well. Positive externalities should be considered a cost to the project (since it does not receive payment for them) and benefit to consumers or some other more specific group if it can be identified; conversely, negative externalities are a gain to the project and a loss to consumers.

### *Material inputs*

The economic analysis in stage two indicated that the project paid 3,300 more than the economic value of its imported material inputs because of taxes to the government (table 12, line 1.1.1/2.1.1). However, the producer pays the government

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<sup>89</sup> If subsidized housing or any other amenities such as lunches or health care are required to hold the workers, they are, in effect, part of the shadow wage rate. If these fringe benefits are worth, say, 300, this amount should be entered as a wage payment in kind at both market and shadow prices; since there is no difference between them in this case, there is no distortion and thus no income flow generated.

1,870 less than the economic value of the foreign exchange required to purchase the imports, leaving the project and the government with a net loss and gain respectively of 1,430. The project suffers its heaviest income losses next to its payments for unskilled labour in its purchases of domestic materials, which are overpriced in economic terms by 3,075, a gain to the local producers and importers. Since these materials have only a 31 per cent traded component, the counterbalancing saving relating to the foreign exchange the project did not have to spend to obtain these materials is only 550, leaving it with a net income loss for this item of 2,525.

#### *Utilities etc.*

It is assumed in this example that financial prices paid by the project for utilities are equal to efficiency prices and that no foreign exchange impact is involved. Therefore, no flows deriving from market-price distortions exist to redistribute income. In an actual application, this entry would cover, for example, water, electricity, transport services, gas, rent and repairs. It would also cover the tax or subsidy element in government charges for such services, as well as any other indirect business taxes or subsidies on production as opposed to income. For example, if the government charges \$0.03 per kilowatt hour for electricity and its economic cost of production is \$0.07 per kilowatt hour, the firm receives a \$0.04 per kilowatt hour subsidy, which should be accounted for by noting income gain to the project equal to \$0.04 times the kilowatt-hour consumption of the project (or, since the subsidy is \$0.04 and the cost is \$0.03, an amount equal to  $4/3$ , or 1.33 times the project's cost of power).

When dealing with payments to the government, the analyst must be careful to distinguish between economic costs and transfer payments. For example, a flat excise tax on each bottle of cosmetic produced is clearly a transfer payment that should be counted as an income flow; on the other hand, a pay-roll tax on each worker that goes into a government-run pension fund for workers should be considered part of the cost of labour.

#### *Labour*

The skilled labour used by the project in this example is paid its efficiency cost; thus no distributional income flows are generated. If, however, skilled workers were paid less than their real economic value for various institutional reasons and if they were in fixed supply, there would be a loss to the rest of the business sector that had previously enjoyed their underpriced services and a corresponding gain to the project. Unskilled labour, on the other hand, is assumed to have a shadow wage 50 per cent of the market wage. Thus it is paid 2,950 more than its economic value, which generates a loss to the project and a gain to the unskilled workers (table 12, line 1.1.1/2.2.1/1). If the unskilled workers had been drawn from the ranks of the unemployed where they had a zero marginal product, their simple efficiency shadow wage would have been zero, assuming no social value on forgone leisure and no increased caloric intake requirements or urban migration. In this event, the entire market wage would represent a net income gain to this class and a loss to the project of an equal amount. If the unskilled workers had previously lived as unemployed

persons in rural areas on shared family income and moved to the city to take the job, and if rural and urban low-income classes are considered separately in analysis, the shared income no longer consumed by the workers in the rural areas would represent a gain to the rural poor who would no longer have to share income with the departed worker. Any additional income now enjoyed by the unskilled worker would represent a gain to his class, and the entire amount of his wages (which are equal to formerly shared income plus additional income) would represent a loss to the project.

As far as owner-operator workers are concerned, it was suggested in stage two that an adjustment be made in the economic analysis for the shadow wage of the entrepreneur as worker. This approach more accurately reveals the economic merit of the project, but it does not make any difference as far as the income-flow analysis is concerned. The adjustment is recorded as a gain to the owner-operator, but it is simultaneously recorded as a loss to the owner-operator because he did not receive it. Since the project and the owner-operator are one and the same, the results cancel out and, *in practice*, can be ignored for the purposes of income-distribution analysis.

If the project had employed foreign labour, there would have been no economic adjustment, for foreign labour almost without exception is paid its opportunity cost. To the extent, however, that the foreign workers repatriate part of their earnings, there would have been an item in the foreign exchange adjustment table to account for the fact that the foreign workers can buy more dollars with their rupee wages than would be possible at the shadow exchange rate. The result is a gain to the external sector and a loss to the project, which gives up the rights to this foreign exchange.<sup>90</sup>

#### *Current assets*

Since section 1.2 of table 12 is concerned with real as opposed to financial assets, the only current assets of relevance from tables 10 and 11 are inventories. (Cash and receivables are dealt with in the financial sections of these tables. In this example, however, no adjustments were required in these items; thus they do not appear in table 12.) The present project recovered its full investment in inventories at the end of its life. Consequently at a 0 per cent discount rate, there is no net present value to adjust. However, at a 10 per cent discount rate, the project suffered a net loss of 133, which consisted of excess costs for domestic goods and taxes on imported goods, losses that were not fully compensated by foreign exchange savings.

#### *Fixed assets*

The cost of the investment made by the project sponsors for the fixed assets were inflated, in this case, by excess labour and material costs on the buildings and by excess domestic prices and import taxes on the equipment and machinery. Of the

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<sup>90</sup> Although it was stated above that the project is involved in every transaction recorded in the income-flow table, if the project pays in rupees that the foreign worker converts into dollars at the Central Bank, the balancing loss should be shown in the column for the government sector, rather than in the one for the project. The project is still involved, however, for without it, this transaction would not have occurred.

300 of excess costs on land and buildings shown in table 12, 150 are assumed to have come from payments to domestic producers for inefficiently produced materials that could theoretically have been imported. The other 150 went to workers for wages above the opportunity cost of labour. Likewise, with the equipment, the loss of 30 by the project is counterbalanced by the workers' gain of 15 due to inflated wages for the labour embodied in the machinery and by the rest of the private sector's gain of 15 due to excess profits on the manufacture of the equipment.

### *Financial flows*

The above-mentioned categories cover all the receipts and expenses included in the operating net cash flow of the project. There are, however, other flows involved in financing the project and in distributing its profits that may affect income distribution.

The project is assumed in this example to have received foreign currency in exchange for equity stock, which, given the distorted market exchange rate, was overvalued with respect to the foreign currency received. Hence, the net present value of the differences (280) must be recorded as a gain to the project and a loss to the foreign investor (line 2.1.1). If the project had used some of its retained earnings or other available funds to purchase securities in firms abroad, and if it had purchased the foreign exchange from the government at an overvalued exchange rate, there would have been a loss to the government and a gain to the project.

In the present example, the project borrowed funds from the government at a subsidized interest rate lower than the opportunity cost of capital, resulting in a gain to the project of 490 and a corresponding loss to the government. The income flow generated by a concessional lending rate, i.e. the present value of the lending-rate subsidy, is equal to the present value at the opportunity cost of capital of the stream of loan repayments minus the amount of the loan, which by definition is equal to the present value of loan repayments at the rate of interest actually paid.

The payment of income taxes does not affect the real net-present-value calculation because this calculation is done on a before-tax basis, but such taxes do affect the private profitability of the firm and thus the distribution of income. In the present example, there is a loss of 900 by the project and a corresponding gain by the government

The payment of dividends can also affect the distribution of income. Although still not very common, some governments have ordered the establishment of profit-sharing schemes for workers in private-sector companies, so that there may be a distribution of income out of profits to the poorer classes that should be considered. Much more common and important from a national point of view, however, is the payment of dividends or other forms of profit remittance to foreign partners. When profits leave the country in this fashion, they generally have no social value. In the present case the project is assumed to remit 900 of profits for foreign owners, which is reflected in a corresponding loss to the project and gain in the external sector. This loss is counterbalanced slightly, however, by the fact that the project bought the needed foreign exchange from the government at an overvalued exchange rate, resulting in a loss of 45 to the government and a corresponding gain to the project.

## Conclusions

The income-flow analysis of table 12 has now been completed except for summing up the net gains and losses by each group, which gives the net distribution impact, i.e. the simple algebraic sum of each of the net gains or losses caused by distortions in the market price of each of the relevant transactions of the project.

## Implications

This table is strictly objective or "positive" in the sense that no "normative" judgements<sup>91</sup> are passed on whether the pattern of income-distribution flows induced by the project are bad or good. The table does not place a value on these flows or calculate an adjustment in the economic net present value that would provide a social net present value. The adjustment is made in stages three and four. All that can be done at this point is to observe what would happen if the project were implemented.

What was shown in general terms by the above analysis of the present sample project was a substantial net transfer from the consumers in general to all other groups, but especially to the workers and to private business, excluding the project. Depending on the savings patterns and the weights placed on the income of each of these groups in stages three and four, this transfer may or may not be significant and will depend in large part on the type of product. Since the present example is based on tractors, it is unlikely that the unskilled factory workers and those who purchase tractors are in the same socio-economic group; thus there may be some significant redistribution. The other gains by the project, the government and the external sector are smaller, but the weights assigned in stages three and four may increase their significance (e.g. if the government has a high propensity to save and if income going to the external sector has no social value).

The integrated documentation system in general and the income-flow table in particular make it fairly easy to draw some policy implications from the data. An example is given below. (*In practice*, of course, this analysis should be based on the present values calculated using the accounting rate of interest.)

First, even after taxes and payments of foreign dividends, as reflected in the income-flow table, the project still gains 1,260 more than the 7,755 net economic value it produces. If the 900 of foreign dividends (including foreign exchange adjustment) are added back on the basis that they go to owners of the company, the project receives 2,160 more than its contribution to economic net present value, a substantial incentive that helps explain why the financial rate of return is nearly 25 per cent higher than the economic rate of return. A closer look at the pattern of gains and losses for the project indicates some disturbing features. First, the net distortion in the price of the product (9,480) is larger than the entire economic net present value of the project (7,755); and, since agriculture is usually a vital sector, the "excessive" price of tractors may be inconsistent with farm-productivity goals and policies of the government. Secondly, the gross distortion *per se*, the difference

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<sup>91</sup> Judgements are, of course, required in interpreting long-term government policy to determine the shadow prices, but they should be assessments of what will be, not judgements of what should be.

between domestic market and border rupee price, unadjusted for foreign exchange overvaluation, is about three times the net present value and, of more importance, is over twice the value of the foreign exchange adjustment, indicating a level of protection more than twice the national average.<sup>92</sup>

The project's distortionary gain of 9,480 on sales of output is largely offset by the 3,955 excess the project must pay for inefficiently produced domestic inputs and by the 2,950 of excess wages paid to unskilled workers. Distortions in the price the project pays for its capital assets are negligible, which is good. However, since the project must pay a premium for unskilled workers, there are definite market-price incentives for the producer to choose a more capital-intensive technology than would be indicated by the relative economic values of labour and capital, and the subsidized interest made available by the government accentuates this bias. This subsidized interest rate, however, compensates the project for over 50 per cent of its income taxes, leaving a minor net "distortion" vis-à-vis the government.<sup>93</sup>

The consumers are hurt the most by this project because, even allowing for the overvalued domestic currency (6,320), they still lose 9,480 compared with what they would have paid for the tractors at border prices, even if they had paid import duties equivalent to the 10 per cent overvaluation of the exchange rate. The entire 9,480 gain goes to the project. Because of the excess wages for unskilled labour, both in construction and in operation, the working class comes out ahead by 3,115. In this connection it is well to note that, although income-redistribution effects derive from economic distortions, differences between market and economic value of labour, these distortions are not necessarily bad. From a social point of view, society could very well decide that unskilled workers should receive more, since they are poor. The income-weighting system used in the UNIDO method will lead towards (but certainly not force) the selection of projects that employ such workers. It would be preferable, however, in light of the above-mentioned bias against unskilled workers and towards capital for the government to subsidize the employment of such workers by the amount of the distortion instead of leaving the project to bear these costs.

If the government did subsidize the employment of unskilled workers by the amount of the difference between their shadow and market wages, there would be two entries under unskilled workers. The first would, as now, indicate a loss by the project and a gain by the workers of 2,950; the second would indicate a gain to the project and a loss to the government of 2,950 due to the wage subsidy, leaving the project with no net gain or loss.

The government comes out on balance with a substantial gain (1,795). It gained from import duties on the materials imported for the project, but lost by making

<sup>92</sup> The level of protection on the output can be calculated from the economic adjustment factor of -20 per cent (table 10, line 1.1.1/1). This factor implies that the economic value is only 80 per cent of the market value, and as 1.0 (the market value) divided by 0.8 (the economic value) is 1.25, the protection is 25 per cent. This compares with the 10 per cent level of protection assumed in the foreign exchange adjustment factor (table 11).

<sup>93</sup> It may not really be correct in the final analysis to refer to income taxes as distortionary because, aside from their socially desirable income-distribution effects, they help pay for government services such as police and fire protection, education and health for workers and maintenance of national transportation and communication networks, all of which are vital to a project's productivity. In a very real sense, these taxes may be considered a user charge for services rendered rather than a unilateral transfer payment with no *quid pro quo*. However, since that is true for all projects, and since national accounts conventions call for them to be treated as transfer payments, they are in this *Guide*.

foreign exchange available to the project at an overvalued exchange rate,<sup>94</sup> leaving it with a net gain in this transaction of 1,430. Its gains and losses on interest subsidies and taxes netted out to a nominal sum.

This section shows that, because of its macro policy implications, the income-flow-analysis table can be valuable not only to the project analyst, but to the national economic policy makers as well.

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<sup>94</sup> There is some question whether the government or some other group bears the costs and benefits of an overvalued exchange rate. In a sense, the entire economy suffers from distorted trade policies, which is a further argument for assigning such gains and losses to the government; in the absence of more specific information about losers or gainers, the government can be used as a surrogate for the country as a whole.

## VI. STAGE THREE: DISTRIBUTION OF BENEFITS OVER TIME— THE SAVINGS IMPACT

The difference between consumption and savings is, in the final analysis, the difference between consuming now and consuming later. Additional future consumption is made possible when investment yields its returns. For this reason, the impact of a project on savings is often spoken of as intertemporal income distribution. To the extent that a dollar invested today will yield more than enough a year from now to repay the cost of waiting until then to consume, savings are more valuable than consumption, and capital is said to be relatively scarce, a common situation in developing countries. It would, of course, be more "efficient" in most cases for the government to ensure that savings shall be adequate by increasing interest rates, a point similar to that made below in the case of influencing income distribution among contemporaries through macro-economic policies instead of through project selection.

Nevertheless, it is important to examine the impact of projects on savings and consumption, often a vital consideration in the choice between a capital-intensive and a labour-intensive project or between different designs for the same project. On the one hand, labour-intensive projects tend to distribute more income to the low-income groups. On the other, the wealthy, who generally receive most of the benefits of capital-intensive projects, tend to save and reinvest more than do the poor. Thus, if there were two alternative projects, for example, one of them labour intensive and the other capital intensive, and if both had essentially the same net present value in terms of stage two economic efficiency, the relative importance of savings and income distribution would be critical. Stage three is, therefore, designed to:

(a) Determine the amount of income gained or lost because of the project by different income groups;

(b) Evaluate the net impact of these gains and losses on savings given the marginal propensity to save of each of these groups;

(c) Place a premium on the additional savings the project will induce by its impact on income distribution.<sup>95</sup>

These three steps are reflected in the table on the economic value of savings (table 13), which has been set up in standardized form to facilitate calculating the adjustment factor for the value of the savings impact ( $AF_s$ ).

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<sup>95</sup>There is no need to place a premium on the savings used up by the project's initial investment because, through the mechanics of the discounted cash-flow analysis, the recovery of capital cost (of the investment funds) is automatically considered. The period during which these savings are used by the project is accounted for by using the consumption rate of interest as the discount rate. In effect, since the discussion is in terms of present values, the investment cost plus any net earnings are available today for either investment or consumption.



### Distribution

Measurement of the income distribution induced by the project needs little discussion here, for this information is derived according to the procedures laid out in chapter V. Once a standard income-flow analysis has been completed (table 12), the information from the bottom line for each discount rate should be transferred to the first column of table 13 (economic value of savings), where space is provided for the gains and losses of each of the groups identified in chapter V at each of the three discount rates.

### Savings impact

The effect on savings of this income redistribution depends on the percentage of additional income each of these groups saves, its marginal propensity to save (MPS). These data, which should be available in many countries from household expenditure surveys, are entered for each group in the second column in decimal form. The additional income (plus or minus) in the first column is then multiplied by this factor to obtain the net savings impact by group (column 3). These values are then added up with the appropriate signs to obtain the net savings impact (column 4).

The sample project in this *Guide* resulted in a net increase in savings of 520,<sup>96</sup> largely because income was taken away from consumers who have a relatively low savings rate and given to the private business sector and the government, which have relatively high rates. The increase would have been greater, however, had the 3,115 that went to workers gone to a group with a higher propensity to save.<sup>97</sup>

### Valuation of savings impact

We now know the project increased savings by 520, but what value does this have to society when compared with consumption? Before this question can be answered, the social premium on investment must be found, either by calculation or estimation.

The adjustment factor for savings ( $AF_s$ ) measures the percentage by which the social value of a rupee invested exceeds that of one consumed. If it is to be calculated, the following formula is used:

$$AF_s = \left[ \frac{(1-s)q}{i-sq} \right] - 1 = \left[ \frac{MPC (MP^{cap})}{CRI - MP^{cap} (MPS)} \right] - 1$$

This formula, which is identical to that used in the *Guidelines* for the social price of investment ( $p^{inv}$ ) except for the subtraction of unity, is given here both in

<sup>96</sup>For simplicity, only values at a zero discount rate are referenced in the text; all three present values should, of course, be used.

<sup>97</sup>It may be interesting to note that, as an adjustment is made for that part of the incremental government income that is saved, this *Guide*, unlike the original Little-Mirrlees and UNIDO methods, takes into account the differences between both government and private consumption and saving.

conventional symbols and in abbreviations that make the relations a bit more clear. The meaning of the symbols and abbreviations is as follows:

MPC	=	$1 - s$	=	marginal propensity to consume
MPS	=	$s$	=	marginal propensity to save
MP <sup>cap</sup>	=	$q$	=	marginal productivity of capital <sup>98</sup>
CRI	=	$i$	=	consumption rate of interest.

This simplified equation for the savings adjustment factor is valid only if:

(a) The time until saving becomes optimal and the premium becomes zero is infinitely far in the future;

(b) The marginal propensity to save, the marginal productivity of capital, and the consumption rate of interest are all constant over time.

Also, if this premium is to be applied to the net present values of the savings impact determined as described above rather than to the annual value of savings impacts, it must be assumed that:

(c) The premium on savings over consumption remains constant over time (which is implicit in (b) above).

*In practice*, because of the lack of better information, it is convenient to accept these assumptions unless there are obvious reasons not to do so.

Granting these assumptions, this formula says in effect that the premium on investment over consumption expressed in terms of consumption is equal to the annual consumption out of the marginal product of capital ( $MPC \times MP^{cap}$ ), discounted to the present by the factor  $CRI - MPS \times MP^{cap}$ , which is the consumption rate of interest, minus the rate at which the marginal product of capital is reinvested and generates additional flows of consumption benefits. While this formula for the  $AF_s$  is fairly widely used, it is highly sensitive to the relative values of the variables chosen and can give ridiculous answers very easily when the difference between  $CRI$  and  $MP^{cap} \times MPS$  is small. For example, if the following values are assumed (per cent):

MPS	30
MPC	70
MP <sup>cap</sup>	15
CRI	5

the resulting adjustment factor for savings is +2,000 per cent, and 1 rupee of savings is worth 21 rupees of consumption.

<sup>98</sup> The marginal productivity of capital may be calculated by several methods, including the measurement of the increase in national product in constant prices over a period compared with the increase in real investment (i.e. the inverse of the conventional incremental capital/output ratio). This estimate should then be adjusted to account for the increase in product due to labour and other factors. Such an adjustment may be made roughly by observing the increase in employment over the same period and the shares of value added that go to each factor of production. At best, however, estimates of the marginal product of capital made in this fashion are still very crude. At worst, these estimates are highly sensitive to relatively minor changes in assumptions and tend to be unstable. Consequently, *in practice*, it is often best to treat the marginal product of capital as a budgetary device along the lines suggested on p. 42 where the cut-off discount rate is regarded more as a means of allocating available funds than as a reflection of economic reality.

These values have admittedly been pushed close to the limits of plausibility to prove a point, but the savings situation in any country is unlikely to become so desperate that savings would be more than two or three times as valuable as consumption.

*In practice*, therefore, the planners may want to set the premium on savings more on the basis of a subjective valuation of the difficulty the country has in raising the capital required for its investment programme than on the basis of some elegant but often misleading formula. An adjustment factor of between 0 and 20 per cent would probably be a good starting point.

Once the adjustment factor for savings has been determined, it is used to convert the additional savings generated by the project into an equivalent value of consumption, the *numéraire* in this method. In the example in table 13, the  $AF_s$  at the three consumption rates of interest used for sensitivity testing were 600 per cent, 220 per cent and 110 per cent (column 5). These, multiplied by the net savings impact (column 4), give the adjustment values (column 6) at each of the adjustment factors and discount rates.

The reader, guessing that table 13 is not the last point where sensitivity testing is going to be applied, may wonder how an analyst could possibly apply, for example, three sets of income-distribution weights based on alternative values of the elasticity of the marginal utility of income and still keep the number of figures under control. Three sets of weights times the nine values in column 6 of table 13 give 27 estimates of project value to juggle, all in the same stage. To avoid this unmanageable situation, the estimates at the end of the present stage should be consolidated, at least temporarily, into a single set of three figures (one at each discount rate). This is done quite easily by weighting each of the three estimated adjustment factors for savings by the probability that each is the correct one. The values used to obtain the figures in columns 7 and 8 are given in the footnote to the table. This probability analysis greatly simplifies the work of the analyst; but, as it is not applied until the value of the impacts at each of the various adjustment factors has been calculated, it does not destroy potentially useful information about the possible range of values. If he wishes, the analyst can always come back and go through the remaining steps with a different set of assumptions about the probabilities attached to each of the possible adjustment factors.

Once the adjustment values for savings impact have been calculated, they should be added to the net present values of stage two to obtain in stage three an estimate of the project's merit. This consolidation of the results is handled in the project summary matrix in chapter IX. Also, once the new net present values have been calculated, a new line can be added to the graph to determine the internal rate of return for stage three.

## VII. STAGE FOUR: DISTRIBUTION OF BENEFITS AMONG CONTEMPORARIES— THE INCOME-DISTRIBUTION IMPACT

When the only objective of government planners in selecting projects is to maximize the present value of net aggregate-consumption benefits from production at shadow prices, taking into consideration impacts of the project on the national savings objectives, stage three of the UNIDO analysis is the end. In many countries, however, the redistribution of income between the public and private sectors to specific regions or to specific income classes is of high priority when projects are selected because the government has not been able (or willing) to accomplish this redistribution more directly and efficiently through macro-economic policy measures such as taxes and subsidies. It then becomes necessary to evaluate the impact on this objective of all projects and to adjust their net present values depending on the importance placed on the objective and on the degree to which they help accomplish it.<sup>99</sup>

The analysis in this stage is relatively easy because the project's distribution impact on income flows has been measured in preparation for stage three according to the method outlined in chapter V. Provided that the target groups for income distribution have been identified separately in the standard income-flow table (table 12), the net gain or loss of income by each group is known. If the analyst wishes to evaluate the income-distribution impact on a regional basis, this table should be broken down further by region so that individuals in each income class in the target region can be identified. Treatment by region of payments and receipts for resources, including output, material inputs, labour and capital, requires careful thought regarding the source and destination of the resources involved and the use to which they would have been put in the project's absence. After the net impact on the group and/or region has been calculated, weights must be assigned to reflect the relative value of income in the hands of the various groups.

### **Distribution adjustment factors**

The stage two calculations ignored the fact that income going to some groups and some regions is more valuable than that going to others from the point of view of income distribution; all income was added together as though it were equal. Thus it might seem logical to go back to stage two, adjust the income of each group separately to reflect these differential social values, then add up the net benefits again to obtain a revised estimate of the net benefit, taking income distribution into account.

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<sup>99</sup> All projects with other than "average" or neutral distribution effects must be included. If a premium were added only to some of the "non-average" projects, their net present value could be raised above that of projects that were even better but for which an analysis of the impact on distribution objectives was not done.

While the logic behind this approach is obvious, this method would involve a great deal of extra work once stage three has been reached. *In practice*, it is far easier to calculate distribution adjustment factors ( $AF_d$ ) that reflect the percentage premium or penalty attached by society to income flows to groups below or above some reference level of income. The income-flow values from stage three are then multiplied by these adjustment factors, and the product is added to or subtracted from the stage three net present values, which have been adjusted for savings impacts, to obtain social net present values that reflect the income-distribution impact of the project. The adjustment factor will naturally be negative for income flows to the rich and positive for those to the poor. The premiums and discounts attached to various groups must, of course, be assumed to remain constant over time to use this present-value-added adjustment method; if not, the adjustments must be made to the annual values.

### Estimation of distribution weights

The determination of the adjustment factors or weights to be placed on income going to different groups is by no means a mechanical process based on empirical evidence; it depends very heavily on political judgement. The *Guidelines* suggests that weights be determined through an iterative process between the analysts "at the bottom" and the politicians or planners "at the top". Using the preferences revealed by the planners for projects with different net present values and distribution impacts, the analysts can determine the weights these planners implicitly assign when they accept some projects and reject others.

Assume, for example, that the analysts first present a project with a negative net present value of Rs 1 million as calculated in stage three of the UNIDO analysis (i.e. before consideration is given to income distribution among contemporaries). Two income groups have been identified: people with income less than Rs 100 per month and the rest of the economy. Assume also that distributional analysis like that presented in chapter V shows that the project over its life would generate incremental income flows to the low-income group of Rs 5 million in net present-value terms. If the planners accept the project, it implies that they place a premium of at least 20 per cent on income going to the poor, for 20 per cent of Rs 5 million is Rs 1 million, which, when added to the negative net present value of Rs 1 million, will bring the net present value of the project to zero, the marginally acceptable level. If the planners reject this project, but accept others requiring at least a 15 per cent premium on income going to the poor, the project analysts know that the switching value of the premium lies somewhere between 15 and 20 per cent. Provided that the planners are consistent over time and that all other non-quantified factors are equal, a usable weight to be placed on income distribution can be derived by this process. (The iterative process between the analysts and the decision makers in determining the premium on income going to the poor is very similar to that mentioned above (pp. 50-51) for determining the cut-off discount rate.)

This procedure for determining weights, and thus adjustment factors, for income distribution works well if only two groups are involved. If more than two are involved, however, this "bottom-up" switching-value procedure becomes unworkable. The number of unknown weights becomes so great that the analysts at the bottom will never be able to determine from the judgements of the planners at the

top what combination of weights they actually placed on income to the various groups. In such instances, a slightly more sophisticated method is needed, which, by moving the analysis back one level to focus on a single factor that determines the income-distribution weights, reduces the number of unknowns and makes the system amenable to solution with the "bottom-up" technique.<sup>100</sup>

This single factor is the elasticity of the marginal utility of income, or, in simple terms, the percentage by which the social value placed on additional income falls with a 1 per cent rise in income. (See annex III, which gives the formula used to calculate the weights shown in the following paragraphs.) For example, if the value of this indicator is taken as zero, additional income at all levels is equally valuable from a social point of view. If the value is 1.0, a 1 per cent increase in income of a person earning Rs 100 per year is just as socially valuable as a 1 per cent increase in the income of a person earning Rs 1,000 or Rs 10,000 per year. This would imply a weight of 1/10 at the Rs 1,000 level and of 1/100 at the Rs 10,000 level if the weight at the Rs 100 level is taken as 1.0. With this approach, the sensitivity analysis in the "bottom-up" procedure focuses on the elasticity of the marginal utility of income. Consistent sets of weights are derived based on alternative values for  $n$  and these sets, rather than individual weights, become the basis of the sensitivity testing. It is important to underline once more that  $n$  reflects public or social judgements; the private individual is likely to have quite a different view about the value of any additional income he receives.

Before income-distribution weights can be determined, some point on the income scale must be specified to which other incomes can be compared, a point where the weight is 1.0. This point becomes the *numéraire* level, and all incomes received at other levels have to be adjusted to their equivalent value at this level. The section of chapter III on the *numéraire* suggested assigning a value of 1.0 to income at the base level of consumption, the level of *per capita* consumption at which additional income going to a private individual is considered as valuable as income going to the government.<sup>101</sup> Theoretically, the determination of the base level of consumption involves a detailed analysis of the value of government income and of income at different levels. *In practice*, however, the base level of consumption may be estimated by reference to the level of income at which people are neither taxed, as are those with more than a certain amount of income, nor subsidized, as are those who receive welfare cheques, food subsidies, and the like, because their income is below a given cut-off level.<sup>102</sup>

To continue the example that has been pursued so far in this book, let us assume that the *per capita* consumption in the groups identified in the income-flow table (table 12) is as indicated in table 14. The *per capita* consumption for the government has been given as base level by definition. It is assumed that the consumers are also at the base level of consumption and that this level is 5,000 *per capita* per year. The *per*

<sup>100</sup>The remainder of this section, which goes beyond the original *Guidelines*, is based in large part on the work of Little and Mirrlees, *op. cit.*

<sup>101</sup>Again, credit and thanks for this concept go to Little and Mirrlees, *op. cit.*, pp. 238-242. Although not theoretically correct, the terms "consumption" and "income" are used interchangeably throughout the income-distribution discussions in this *Guide*. A more precise differentiation in practice can lead to substantial problems in collecting and manipulating data, and in most cases the error caused by this simplification should be minor.

<sup>102</sup>Here an implicit assumption is made that the government's revenue structure and expenditure patterns are optimal. If this assumption is clearly violated in reality, appropriate adjustments should be made.

*capita* consumption of the external sector is given as infinity on the assumption that income leaving the country has no social value at any value of  $n$ .<sup>103</sup>

The weights and income-distribution adjustment factors that would be associated with the above relative levels of income have been determined according to the formula given in annex III and have been recorded in table 14 at three possible values of the elasticity of the marginal utility of income from zero to two, which are generally considered to be the limits of the plausible range of values for  $n$ . As can be seen from this table, a zero value for  $n$ , which is implicitly used whenever projects are evaluated without considering their income-distribution effects, implies that income at all levels is equally valuable (the adjustment factor is zero) and the gains of income by some groups and losses by others recorded in table 12 all cancel out. A value of one for  $n$ , as discussed above, implies that a 1 per cent rise in the level of income is equally valuable at all levels of income. A value of two for  $n$  is an even more strongly egalitarian value, indicating that income received by the workers, in this example, is considered to be one hundred times as valuable as that received by the project.<sup>104</sup>

### Application of distribution weights

Once the income-distribution impacts have been measured through use of the income-flow table (table 12) and the weights for income distribution have been determined above, the valuation of the income-distribution impact is fairly straightforward.

To keep the discussion simple, only the values that resulted from the distribution impact at a 10 per cent discount rate are considered here. *In practice*, this may be desirable to do instead of using three plotting point rates if the CRI is known with reasonable accuracy and if it is used the CRI is used from the outset of stage one as the midpoint discount rate. Then the analysis can be reduced to one discount rate fairly easily in stage four. An equally valuable simplification can be obtained, even if the CRI is not known with certainty, if the probability approach suggested at the end of chapter VI is used. By this stage, the UNIDO analysis is moving into more and more uncertain territory, where political judgements become

<sup>103</sup> Governments should be cautious, incidentally, about pursuing policies that will take away income from the external sector (e.g. by forbidding the repatriation of reasonable profits). The pursuit of such policies may result in a political and commercial antagonism that in the long run could cut off the inward flow of foreign capital. (Although it may seem strange to say that external-sector consumption is infinite, this weighting gives the desired result, as is clear from equation (3) in annex III.) A more intuitive though less exact explanation is that foreign consumption goes to a class so far above the local base level of consumption in terms of national priorities that it may as well be considered infinite.

<sup>104</sup> In this paragraph it is assumed that the elasticity of the marginal utility of income is the same at all income levels. In reality, it may decline as the income level goes up so that income at higher levels is not subject to discounts that increase geometrically. For example, with a value of  $n = 1$ , as shown in table 14, an extra dollar of income at the \$10,000 level is worth only 1/10 of that at the \$1,000 level ( $0.5/5.0 = 0.10$ ). If the elasticity of marginal utility of income remained at 1.0, it would imply that an extra dollar of income to a person at the \$100,000 level would be worth only 1/100 of an extra dollar at the \$1,000 income level from a social point of view. Such a high discount would make it virtually impossible to justify major industrial undertakings in the private sector. Therefore, for pragmatic reasons, the analyst is cautioned against applying the same value of  $n$  at all income levels without first taking a close look at the plausibility of the implications.

as important as economic ones, and decisions must be made as much on the basis of judgement as fact. Consequently, because of uncertainties piling upon uncertainties, the number of options that could theoretically be applied in a sensitivity analysis mushrooms geometrically and can quickly get out of hand unless some simplifying assumptions are made.<sup>105</sup>

Table 15 facilitates the application of the weights derived in table 14. The table presents data for all groups in three sets, one for each basic discount rate, so that in the end a present-value curve adjusted for income-distribution effects can be plotted (see chapter IX, figure V).

The first column of table 15 records the net gain or loss from the last line of table 12. Columns 2-4 record the adjustment factors for income distribution at the three levels of  $n$  (0, 1, 2). Columns 5-7 record the products of the net gain or loss and the distribution adjustment factors. Columns 8 and 9 give a probability-weighted estimate of the adjustment factor for income distribution (based on various values of  $n$ ) and the consequent distribution-impact adjustment values, which indicate the amount by which the net present value of the project will have to be adjusted to account for its distribution impact.

### Analysis of results

Since all income going to domestic groups is considered to have equal value when  $n$  equals zero, it is inevitable that the only adjustment on the " $n = 0$ " column under distribution adjustment values is the -620 for income sent abroad. (This income has no social value to the country.) Since the project received 1,260 of income in addition to the net economic benefits it produced and since income going to the project is less valuable than that at the base level of consumption because the project owners are relatively wealthy, this gain is regarded as a loss to the society, a reallocation of income. Similarly, the gain by the rest of the private business sector is also a social loss because of the relative wealth of this sector. The overwhelmingly important distributional adjustment at values of  $n$  other than zero is the gain by workers of 3,115. Because of their relative poverty (only 20 per cent of the base level of consumption), income going to them is five times as valuable as income at the base level, when  $n$  equals 1.0 and when  $n$  is raised to 2.0, the social value of this income is 25 times the actual flow.

The practical implications of this last point should not be overlooked; the adjustment of 74,670, which results at  $n = 2$  for the workers' income, overwhelms all other influences and yields a net adjustment of roughly the same amount (71,088). This amount is to be added to the net present value of the project to adjust for income-distribution objectives. However, as will be recalled from table 11, the economic net present value of the project at a 0 per cent discount rate after adjustment for the foreign exchange impact was only 7,755 (this yielded about a 19 per cent rate of return, figure V). The impact on the rate of return of adding 71,088 to the net present value is so enormous as to be senseless. A project could be

<sup>105</sup> For example, three rates of discount were used in stages one through three; in stage three, three values for the savings adjustment factor were introduced, which gives  $3 \times 3$ , or 9, alternatives. Now, if three values of  $n$  are used in this fourth stage of the analysis, the number of sensitivity options becomes 27. No sensible planner would simultaneously try to balance all these alternative values in his head; some of the numbers must be dropped to focus decision making on the important issues.



a total economic disaster, but if it had an impact on income distribution of this size and the value of  $n$  were set at 2, it would be "justified" on social grounds.<sup>106</sup>

A second and equally important warning must be made about income-distribution weights: the poor will be just as poor if income going to them is weighted by a factor of 1 or 100. The distribution weights *per se* do not make them a penny richer, for, as the reader will recall from the discussion of *numéraires* on pp. 31-32, the *numéraire* indicates only equivalent social values, not absolute values. The weights can only bias the choice towards projects benefiting the poor. It is, therefore, very important that the same weights be applied in every project. If project A gives the poor an extra 750 of income and project B an extra 500, but the weights used for income going to the poor are 1.1 and 2.0, respectively, the apparent 1,000 from project B will do the poor less good than the apparent 825 from project A.

In sum, the value placed on the income-distribution objective has to be examined very carefully and applied uniformly, especially as income distribution through project selection is generally inferior to implementation of proper economic policies or direct subsidization of the poor from government revenues. *In practice*, however, if moderate weights (say, up to  $n = 0.5$  with tapering at higher income levels) are placed on income-distribution impacts and if the results of the analysis are weighed carefully in terms of the economic net present value that may be forgone or the economic net present costs that may be incurred by pursuing projects for income-distribution effects, a better appreciation of the alternatives in terms of broader social objectives may be obtained. The project summary matrix (table 16) provides a helpful way of keeping these costs in mind.

### Regional income impact

If the development of a poverty-stricken region or a politically sensitive frontier area is a government objective, the same type of analysis as was applied for income distribution to rich and poor can be applied on a regional basis. It will, of course, be necessary to revise the headings in table 12 to identify the target region or regions. If income distribution among rich and poor within the region is also of concern, it could be evaluated by adding regional subdivisions under each income group.<sup>107</sup> The weights to be applied to distribution impacts by region are probably best left to political judgement as revealed through the "bottom-up" procedure or else by direct top-down edict from the national planning office. These should, however, be influenced in part by an evaluation of the income levels in each region as compared with the established base level. An even more effective way of handling income-distribution issues in project appraisal may be to identify the "basic needs"

<sup>106</sup> The net present value at 0 per cent of the fixed asset investment in the project in this example was 6,000 at financial prices and about 5,670 at economic prices. This means that the project could, roughly speaking, lose 4 times its fixed capital investment over each year of its assumed three-year life and still show a positive net present value at "social" prices, clearly an absurd situation.

<sup>107</sup> If the analysis must take both regional and income-group differences into account, both should be considered simultaneously; a sequential analysis would result in double counting. To do both types of distribution analysis simultaneously, the number of groups and weights at each discount rate must equal the number of income groups times the number of regional groups. For example, if there are two income groups (rich and poor) and two regions (urban and rural), four classes must be set up with a weight for each (urban rich, urban poor, rural rich, rural poor).

of target income groups and apply “merit-want” adjustment premiums to the value of the production of these needs in the context of stage five of the UNIDO method (see chapter VIII). This merit-want approach is more explicit in its impact, has a more direct focus on the specific target income group, and is less prone to producing nonsensical results than the income-distribution-weights approach.

### Government or private income impact

The *Guidelines* does not go into detail on the subject of the relative value of public and private income, although many observers have noted that, owing to the difficulties governments often face in establishing an “optimal” tax system to generate the desirable revenues, income in the hands of the government may be more valuable than income in the hands of the private sector.

This *Guide* deals implicitly with the issue. While it is easy to see from line 3.0 of table 12 what the impact of the project on government income will be, it is not necessary to adjust this amount because of the choice of *numéraire* that has been made in this *Guide*. As described above, the *numéraire* is consumption at the base level of income, which, by definition, is the level of *per capita* income at which additional income is equally valuable in government or private hands. Therefore, provided that appropriate adjustments are made in private income received by those above and below this level, there is no need to do anything specifically with the impact on government income created by the project.

### Summary

Stage four of the UNIDO method provides the analyst a means of placing a value on the effects of a project on income distribution between rich and poor and among regions. It also, by virtue of the *numéraire* chosen, adjusts for the relative value of public and private income. Once the impacts have been valued by the adjustment factors, they are added (plus or minus) in the project summary matrix (table 16) to the net present value of the end of stage three to produce the social net present value of the project. The UNIDO analysis will usually end here; but if the social values of the inputs, and especially of the outputs, are thought to diverge from their economic values, stage five should be used. For example, a project producing goods that meet “basic needs” or alcohol or some other product that is “good” or “bad” from a social or political point of view might require stage-five analysis.

## VIII. STAGE FIVE: MERIT AND DEMERIT GOODS— SOCIAL POLITICS

Under some circumstances it may be desirable to adjust the net present value of the project resulting from stage four to account for differences between the efficiency and social value of resources *per se*,<sup>108</sup> as opposed to the adjustments made in stage four to account for the difference between the efficiency and social value of the income that was redistributed because of the project.<sup>109</sup>

When the social value of a good is more than its efficiency value, the good may be called a “merit good” and an upwards adjustment should be made. For example, a country may want foreign exchange simply to increase its ability to withhold its exports for strategic political reasons. Or the country may place a higher social than economic value on, for example, a steel mill thought to have special importance in the context of a strategy to expand its industrial base to reduce its dependence on primary commodity exports. The size of the premium required would be a useful measure of the cost of supporting this form of infant industry. Similarly, a country wishing for political and strategic reasons to limit its dependence on oil imports may place a premium price on petroleum in evaluating projects, thereby giving preference to those that would require less energy or to those that could use locally available energy sources such as coal or geothermal resources. Likewise, it may choose to attach extra value to “basic needs” delivered to people in target income groups, which in effect, becomes a measure of the transfer payment society would be willing to make to attain this or other merit-want goals.

On the other hand, if the social value of a good is less than its efficiency value, it may be called a “demerit good”, and a downwards adjustment should be made. For example, a country may put tobacco/alcohol and luxury consumption items such as high-grade cosmetics and fancy cars in this category.

This approach could even be extended to value the creation of employment *per se* as opposed to the adjustment for the real economic cost of labour (stage two) or to the valuation of income distribution to employees from the poorer classes (stage four). For example, the government could say that, in the absence of the project, for

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<sup>108</sup> Stage two, it will be recalled, corrected for the difference between the market and the economic-efficiency prices of inputs and outputs.

<sup>109</sup> This chapter is not designed for purists who think that economics should be devoid of political or subjective judgements. Indeed, it addresses these problems directly. These are problems of the real world, and investment decisions are made in this world, not in the world of theoretical abstraction. Ignoring these issues will not make them go away; it will only make the advice of the economist partially useful at best and irrelevant to the decision maker at worst. The economist can offer the decision maker a clear, relatively objective analysis of the implications of alternative policies and decisions from the economic point of view even though political factors are involved. This chapter, therefore, seeks, along with the earlier ones dealing with savings and income distribution, to integrate these “normative”, more or less subjective issues into a total methodology for project appraisal. The project summary matrix presented in chapter IX puts these positive and normative analyses side by side so that a rational decision can be made.

social and political reasons it would have to create 10,000 jobs at a cost of 500 per job per year. These would be make-work jobs such as digging holes that would create nothing of social value. It could then say that the "production" of a job by the project is worth 500 per year and should be valued as an "output" at this price. Or it could say that only a certain percentage of the net present value of this amount should be added to the net present value of the project. This percentage or weight would depend on: (a) the weight the government placed on employment generation *per se* as compared with income distribution and (b) the amount of extra consumption that would be generated (stage three) etc.

The procedure for taking into account the differences between the economic and social values of a good is basically the same as in the previous stages. First, its social value is estimated. Next the adjustment factor (premium for merit goods, penalty for demerit goods) is calculated by subtracting unity from the ratio of its social value to its economic value. Its efficiency price is then multiplied by the adjustment factor to obtain the adjustment. This adjustment is added algebraically to the net present value of stage four, and the result recorded in the project summary matrix (table 16).

This procedure can be demonstrated with a simple example. Assume that

- (a) A cigarette factory is under consideration;
- (b) The present economic value of the cigarettes produced in terms of willingness to pay is Rs 10 million;
- (c) The cigarettes are regarded as having no more social value than their cost of production (assumed to be 60 per cent of the market price).

Under these assumptions, the adjustment factor would be  $-0.4$  or  $(\frac{60 \text{ per cent}}{100 \text{ per cent}} - 1)$ .

This factor of  $-0.4$ , reflecting the socially valueless portion of the economic value of the cigarettes, would be applied to the entire Rs 10 million. The resulting adjustment of Rs 4 million would then be subtracted from the net present value of the project to obtain the net present value in terms of socially acceptable consumption. On the other hand, if a particular good were regarded as a merit good that was, say, 50 per cent more socially desirable than indicated by its economic shadow price, 50 per cent of the present value of the output of this good could be added to the net present value of the project in stage five. *In practice*, actual protection (tariffs or equivalent) may be a good indication of the social premium attached to the good.<sup>110</sup> Conversely, if the project consumed a resource whose social value exceeded its economic value, the adjustment would be subtracted from the stage four net present value. This issue might well arise if a hydroelectric project were to flood land held by poor peasant farmers, who would then be forced to join the urban labour force.

The procedure is slightly different in situations such as employment creation, where the socially valuable product does not even appear as an "output" in the economic-efficiency accounts. Such cases must be treated similarly to economic externalities; the annual benefit in social prices is calculated, discounted to the present at 0 per cent, 10 per cent and 20 per cent, added to the basic net present

<sup>110</sup>Note that nothing is said here whether such tariffs are good or bad or whether protection is the most enlightened way of attaining certain social goals. Such can be determined only by the application of all stages of the UNIDO method. Also, since the objectives implicit in tariff protection can be handled explicitly in this method in stage five, the border price should almost always be used as the efficiency value in stage two, regardless of economic policy.

value of the project at each discount rate, and the new adjusted totals are plotted to indicate the rate of return.

A strong word of caution must end this section. Once the analyst begins adjusting values of the goods *per se* for social reasons, even economically disastrous projects can be made to show “good” social rates of return. Furthermore, the borderline between “social” and “political” is extremely thin; it is easy to end up maintaining that politically expedient projects, regardless of how economically wasteful they may be, are “socially” justifiable. There is no certain way to prevent this. The dangers can be reduced, however, by following the stage-by-stage procedures outlined in this *Guide*. This method generates a series of estimates of the project’s desirability, thereby making it possible to see the exact cost in terms of net present value or rate of return forgone of pursuing objectives other than pure economic efficiency.

This cost is emphasized by placing the estimates from each stage side by side in the multiobjective matrix presented as table 16 in annex I. (This table contains arbitrary sample adjustment factors for the project’s impact on industrialization, use of petroleum and employment aside from any “economic-efficiency” impacts that were already counted in earlier stages.)

Once this information is available, the decision maker can weigh the costs against the anticipated social benefits and make his choice.

## IX. PROJECT SUMMARY MATRIX

This *Guide* has stressed from the outset that in selecting projects a country must consider a number of different and often conflicting objectives before choosing the best project or project design. It has also stressed that, while each of these objectives such as financial viability, economic efficiency and social equity has merit in its own right, there is often very little consensus on exactly what weight should be applied to each. Some people will be most concerned about earning or saving foreign exchange, some with establishing a heavy-industry base for future economic growth, and others with the distribution of income, to mention only a few. Most methods of economic project appraisal proposed in the past attempted to derive one number representing a balance of all these factors. If there were any chance in the real world of obtaining a true consensus on the weights that should go into the calculation of such a number, it would be difficult to fault the approach.

*In practice*, however, decision makers are many and agreements few. It is, therefore, much more realistic to develop a variety of insights into the merits of a project and to present these concisely so that all decision makers can explicitly see the various impacts a project will have. It makes their task much easier to be able to understand what the good and the bad points of a project are so that the benefits of pursuing one objective can be measured against the benefits that would be forgone by passing up a project that would pursue a different objective.

The method in this *Guide* has been designed explicitly to develop this type of information. The project summary matrix (table 16) pulls together the key data generated during the various analytical stages in a comparative multiobjective appraisal matrix. The key indicators of project desirability at each stage of analysis are then summarized graphically in figure V.

In this example, only data for the project that has been pursued throughout this book are presented. *In practice*, the analyst should include information on major alternatives so that the decision makers can weigh their choices intelligently. Also, unless the table is going to a very senior decision maker, it should contain additional, more detailed information. Other data that may be useful include more extensive sensitivity analysis with respect to various types of benefits and costs; various degrees of change; in key variables; and alternative timings, including delays of the project completion and delays in reaching full production. These should be added to the economic as well as the financial analysis. More information on the groups whose income is affected by the project and the extent of their gains and losses may also be useful. Likewise, instead of presenting only the best estimate of the adjustment factor for savings and income-distribution impacts, the value of these impacts at the alternative rates indicated in the earlier tables may be of interest. The analyst may also consider inclusion of the traditional static measures such as the effective rate of protection, the Bruno ratio and the direct foreign exchange savings.

Besides helping with the selection of projects, a project summary matrix is a valuable means of pointing out major price distortions and their implications for economic efficiency, savings and income distribution. Policy makers, with this

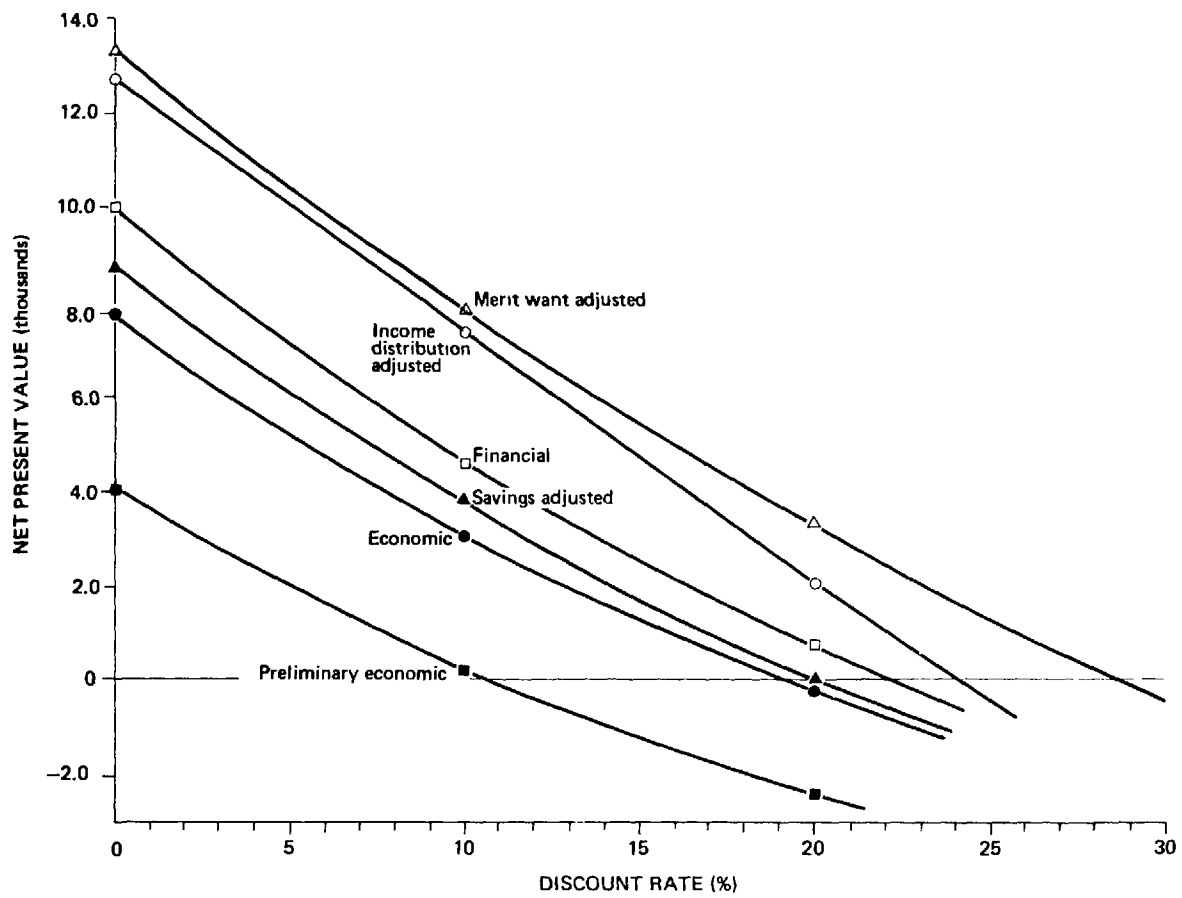


Figure V. Project summary graph

information in hand, will be better able to seek policy changes that will lead to market-price signals that are more consistent with the country's economic and social goals. In fact, this kind of impact could be by far the most useful result of the analytical method presented in this *Guide*, for such policy changes would lead to better investment decisions for projects in all sectors.

The method outlined in this *Guide* is admittedly somewhat complex, but so is the real world with which it is designed to deal. To insist on limiting project appraisal to quantifiable, objective factors is to ignore factors that are often critical to decision making in the real world. Since we cannot make these realities evaporate by ignoring them, our only choice is to incorporate them, however crudely, in an analytical framework that places all relevant factors side by side so that they can be viewed in proper perspective. If this *Guide* helps provide such a framework, it will have accomplished its major objective.



**Annex I**  
**TABLES**

**TABLE 1 FINANCIAL INCOME STATEMENT**  
**(FIS 1 0 - 18 0)**

Item	Present value (in year zero)			Year		
	0%	10%	20%	1	2	3
1 Sales at market prices	(87 625)	(70 098)	(57 407)	11 250	33 125	43 250
2 Excise taxes	8 762	7 009	5 740	1 125	3 312	4 325
3 Sales at factor cost <sup>a</sup>	(78 863)	(63 088)	(51 667)	10 125	29 813	38 925
4 Inventory change (finished goods)	137	413	578	+1 875	187	-1 925
5 Production	79 000	63 501	52 245	12 000	30 000	37 000
6 Material inputs <sup>a</sup>	42 500	34 237	28 229	7 000	16 000	19 500
7 Value added	(36 500)	(29 264)	(24 016)	5 000	14 000	17 500
8 Operating expenses <sup>a</sup>	(26 500)	(21 491)	(17 836)	5 500	9 500	11 500
1 Utilities and services	6 500	5 229	4 306	1 000	2 500	3 000
2 Labour	(12 000)	(9 669)	(7 974)	2 000	4 500	5 500
1/Skilled	6 100	4 914	4 051	1 000	2 300	2 800
2/Unskilled	5 900	4 756	3 924	1 000	2 200	2 700
3 Capital charges	(8 000)	(6 593)	(5 556)	2 500	2 500	3 000
1/Depreciation	6 000	4 974	4 213	2 000	2 000	2 000
2/Amortization, etc.	2 000	1 619	1 343	500	500	1 000
9 Operating profits	(10 000)	(7 772)	(6 181)	- 500	4 500	6 000
10 Interest payments	1 400	1 138	947	400	300	700
11. Net operating profits before tax	(8 600)	(6 635)	(5 234)	- 900	4 200	: 300
12 Other net income	-	-	-	-	-	-
13 Net firm profits before tax	(8 600)	(6 635)	(5 234)	- 900	4 200	5 300
14 Income taxes	900	706	567	-	400	500
15 Profit after tax	(7 700)	(5 929)	(4 667)	- 900	3 800	4 800
16 Dividends	900	676	521	-	-	900
17 Retained earnings	(6 800)	(5 253)	(4 146)	900	3 800	3 900
18 Externalities						

*Note* Numbers in parentheses can be derived from subcomponents (e.g. labour costs are the sum of unskilled and skilled labour costs) or can be derived by subtraction (e.g. gross profit is equal to production minus material inputs) Consideration of such relationships substantially reduces the amount of discounting required.

<sup>a</sup>Indicates supporting documentation is attached

TABLE 2 FINANCIAL CASH FLOW  
(FCF 1 0 - 2 0)

Item	Net present value			Year				
	0%	10%	20%	0	1	2	3	3T <sup>a</sup>
1 Net cash flow—real <sup>b</sup>	10 000	4 581	773	- 13 000	-	4 000	9 000	10 000
1 Sources	18 000	14 365	11 736	-	2 000	7 000	9 000	-
1/Operating profit BIT <sup>c</sup>	10 000	7 772	6 181	-	- 500	4 500	6 000	-
2/Depreciation	6 000	4 974	4 213	-	2 000	2 000	2 000	-
3/Amortization	2 000	1 619	1 343	-	500	500	1 000	-
4/Externalities								
2 Uses (investment)	8 000	9 784	10 963	13 000	2 000	3 000	-	- 10 000
1/Current assets	-	1 287	2 120	3 000	2 000	3 000	-	- 8 000
/1 Inventories	-	1 287	2 120	3 000	2 000	3 000	-	- 8 000
2/Fixed assets	6 000	6 497	6 843	8 000	-	-	-	- 2 000
/1 Land and buildings	3 000	3 497	3 843	5 000	-	-	-	- 2 000
/2 Equipment	3 000	3 000	3 000	3 000	-	-	-	-
3/Other capitalized investments	2 000	2 000	2 000	2 000	-	-	-	-
2 Net cash flow—financial <sup>d</sup>	10 000	- 4 581	- 773	13 000	-	4 000	- 9 000	- 10 000
1 Sources	18 100	17 587	17 181	14 000	2 400	1 700	-	-
1/New borrowings	11 100	10 587	10 181	7 000	2 400	1 700	-	-
2/New equity	7 000	7 000	7 000	7 000	-	-	-	-
2 Uses	28 100	22 168	17 954	1 000	2 400	5 700	9 000	10 000
1/Working capital		940	1 509	1 000	2 000	5 000	2 000	10 000
/1 Cash		482	792	1 000	1 000	1 000	-	- 3 000
/2 Receivables		458	718	-	1 000	4 000	2 000	7 000
2/Debt service	5 400	4 143	3 262	-	400	300	4 700	-
/1 Interest	1 400	1 138	947	-	400	300	700	-
/2 Principal	4 000	3 005	2 315	-	-	-	4 000	-
3 Taxes	900	706	567	-	-	400	500	-
4 Dividends	900	676	521	-	-	-	900	-
5 Other <sup>e</sup>	20 900	15 702	12 095	-	-	-	900	20 000

<sup>a</sup>Column 3T records liquidation of project upon termination at end of third year

<sup>b</sup>“Net cash flow—real” section contains the cash flows relating to the purchase and sale of physical resources required for productive operations, the cash flows needed to calculate the net present value or the rate of return

<sup>c</sup>Before interest and tax

<sup>d</sup>“Net cash flow—financial” contains items related to (i) finance of operating cash flow short falls and/or other expenses, or (ii) use of funds for other than direct production and sales expenses. Because of the inclusion of this section, it would probably be more precise to call this a “fund flow” rather than a “cash flow” table (see glossary)

<sup>e</sup>Includes, for example, securities held in other companies as investments and assets held upon termination

TABLE 3 FINANCIAL BALANCE SHEET<sup>a</sup>  
(FBS 1.0 - 3.0)

Item	Year			
	0	1	2	3
1. Assets				
.1 Current--total	4 000	8 000	16 000	18 000
.1/Cash	1 000	2 000	3 000	3 000
.2/Receivables	-	1 000	5 000	7 000
.3/Inventories	3 000	5 000	8 000	8 000
.2 Fixed (net)--total	8 000	6 000	4 000	2 000
/1 At cost	8 000	8 000	8 000	8 000
/2. Accumulated depreciation	-	2 000	4 000	6 000
.1/Land	2 000	2 000	2 000	2 000
.2/Buildings (net)	3 000	2 000	1 000	-
/1 At cost	3 000	3 000	3 000	3 000
/2 Accumulated depreciation	-	1 000	2 000	3 000
.3/Equipment (net)	3 000	2 000	1 000	-
/1 At cost	3 000	3 000	3 000	3 000
/2 Accumulated depreciation	-	1 000	2 000	3 000
.3 Other capitalized assets	2 000	1 500	1 000	-
.1/At cost	2 000	2 000	2 000	2 000
2/Accumulated amortization	-	500	1 000	2 000
.4. Other (securities etc )	-	-	-	20 900
Total assets	14 000	15 500	21 000	40 900
2. Liabilities	7 000	9 400	11 100	7 100
.1 Current	3 000	5 400	7 100	3 100
1/Payables	3 000	5 400	7 100	3 100
/1 Suppliers	-	2 000	3 000	2 000
/2 Banks	3 000	3 400	4 100	1 100
2/Current long-term debt	-	-	-	-
.3/Other	-	-	-	-
2 Long-term	4 000	4 000	4 000	4 000
3 Net worth	7 000	6 100	9 900	33 800
1 Paid in equity	7 000	7 000	7 000	7 000
2 Retained earnings	-	900	2 900	6 800
3 Other	-	-	-	20 000
Liabilities and net worth	14 000	15 500	21 000	40 900

<sup>a</sup>As of end of financial year

TABLE 4 SALES PROJECTIONS  
(FIS 3 0 - 3 2)

Item	Year		
	1	2	3
3 Sales (factor cost)	10 125	29 813	38 925
1 Light tractors			
1/Value	5 375	15 938	20 675
/1 Northern market	875	1 628	1 880
/2 Southern market	4 500	14 310	18 795
2/Quantity <sup>a b</sup>	120	327	416
/1 Northern market	20	35	40
/2 Southern market	100	292	376
3/Price (each) <sup>c</sup> -average	44 79	48 70	49 70
/1 Northern market	43 75	46 50	47 00
/2 Southern market	45 00	49 00	49 99
2 Heavy tractors			
1/Value	4 750	13 875	18 250
/1 Northern market	1 500	1 875	2 250
/2 Southern market	3 250	12 000	16 000
2/Quantity	75	175	230
/1 Northern market	25	25	30
/2 Southern market	50	150	200
3/Price (each)-average	63 33	79 28	79 35
/1 Northern market	60 00	75 00	75 00
/2 Southern market	65 00	80 00	80 00

<sup>a</sup>Indicates supporting documentation is attached

<sup>b</sup>Assumptions (sample only) southern market will begin at five times the size of northern market and grow much more rapidly

<sup>c</sup>Assumptions (sample only) because of higher income levels, price in southern market will be higher than in northern. In both markets prices will be lower initially as an introductory offer

TABLE 5 SALES PROJECTIONS LIGHT TRACTORS-QUANTITY  
(FIS 3 1 2)

Item	Year		
	1	2	3
3 1 2/Light tractors	120	327	416
/1 Northern market	20	35	40
1 Abba zone	15	25	30
2 Other zones	5	10	10
/2 Southern market	100	292	376
1 Kadur zone	50	200	251
2 Other zones	50	92	125

TABLE 6 MATERIAL REQUIREMENTS  
(FIS 6 0 - 6 2 1/1)

Item	Present value (in year zero)			Year		
	0%	10%	20%	1	2	3
6 Material inputs	42 500	34 237	28 229	7 000	16 000	19 500
1 Domestic	20 500	16 439	13 495	3 000	7 500	10 000
1/Basic	a	a	a	2 000	5 000	7 000
/1 Steel	a	a	a	2 000	5 000	7 000
2/Other	a	a	a	1 000	2 500	3 000
/1 Paint	a	a	a	200	500	600
/2 Other process mat	a	a	a	800	2 000	2 400
2 Imported	22 000	17 798	14 734	4 000	8 500	9 500
1/Basic	a	a	a	4 000	8 500	9 500
/1 CKD components	a	a	a	4 000	8 500	9 500

<sup>a</sup>Present value of subdivisions included in total (there is no need to calculate the net present value of items whose market value will not be adjusted individually to reflect economic or social values) The implicit assumption that there are no distortions will probably not be reasonable in practice

TABLE 7 OPERATING EXPENSES  
(FIS 8 0 - 8 3)

Item	Present value (in year zero)			Year		
	0%	10%	20%	1	2	3
8 1 Utilities and services	6 500	5 229	4 306	1 000	2 500	3 000
1/Utilities	a	a	a	100	200	200
2/Transport	a	a	a	100	300	400
3/Selling and administration	a	a	a	500	1 000	1 000
4/Technology	a	a	a	-	100	100
5/Indirect business taxes	a	a	a	300	800	900
6/Miscellaneous	a	a	a	-	100	400
8 2 Labour	(12 000)	(9 669)	(7 974)	2 000	4 500	5 500
1/Skilled	6 100	4 914	4 051	1 000	2 300	2 800
2/Unskilled	5 900	4 756	3 924	1 000	2 200	2 700
8 3 Capital charges	(8 000)	(6 592)	(5 556)	2 500	2 500	3 000
1/Depreciation	6 000	4 974	4 213	2 000	2 000	2 000
2/Amortization etc	2 000	1 619	1 343	500	500	1 000
/1 Amortization	a	a	a	-	50	100
/2 Lease expenses	a	a	a	100	150	300
/3 Other capitalized expenses	a	a	a	400	300	600

<sup>a</sup>Present value of subdivisions included in total (there is no need to calculate the net present value of items whose market value will not be adjusted individually to reflect economic or social values) The implicit assumption that there are no distortions will probably not be reasonable in practice

TABLE 8 FINANCIAL DISCOUNTED CASH-FLOW ANALYSIS

Item	Net present value				Year			
	0%	10%	20%	(13%)	0	5	10	15
Sources <sup>a</sup>								
Sales	5 000	2 076	1 048	1 665	-	1 667	1 667	1 667
Costs	2 000	830	419	665	-	667	667	667
Profit	3 000	1 246	629	1 000	-	1 000	1 000	1 000
Uses								
Investment	1 000	1 000	1 000	1 000	1 000	-	-	-
Net cash flow	2 000	246	- 371	-	- 1 000	1 000	1 000	1 000

<sup>a</sup>Ratio of economic to financial value minus 1.0, i.e. the premium or discount required to move from financial to economic values. The adjustment factor is discussed in more detail on p. 32.

TABLE 9. ECONOMIC ANALYSIS

Item	Net present value				Factor <sup>a</sup>	Economic adjustment		
	0%	10%	20%	Factor <sup>a</sup>		0%	10%	20%
Financial sources <sup>a</sup>								
Sales	5 000	2 076	1 048	- 20%	- 1 000	- 415	- 210	
Costs	2 000	830	419	-	-	-	-	
Profit	3 000	1 246	629	...	- 1 000	- 415	- 210	
Uses								
Investment	1 000	1 000	1 000	-	-	-	-	
Net cash flow	2 000	246	- 371	.	...	..	...	
Net adjustments	- 1 000	- 415	- 210	...	- 1 000	- 415	- 210	
Economic cash flow	1 000	- 169	- 581	...	...	...	...	

<sup>a</sup>Only operating costs such as materials, labour and utilities are included here. Therefore, profit is gross profit before depreciation, interest, taxes etc. This definition of costs and profits yields a net cash-flow value that can then be discounted to obtain the project's net present value.

TABLE 10 ADJUSTMENT TO CASH FLOW MARKET-PRICE DISTORTION

Item <sup>a</sup>	Financial net present value			Adjustment to cash flow				Preliminary adjusted present value		
	0%	10%	20%	Factor <sup>b</sup>	0%	10%	20%	0%	10%	20%
1 Net cash flow—real	10 000	4 581	773		- 5 875	- 4 280	- 3 145	4 125	301	- 2 372
1 Operating sources of funds	18 000	14 365	11 736		- 6 475	- 5 187	- 4 253	11 525	9 178	7 483
1/Operating profit (before interest or tax)										
/1 Production value	79 000	63 501	52 245	- 20%	- 15 800	- 12 700	- 10 449	63 200	50 801	41 796
/2 Costs										
1 Materials										
1/Imported	22 000	17 798	14 734	- 15%	- 3 300	- 2 670	- 2 210	18 700	15 128	12 524
2/Domestic	20 500	16 439	13 495	- 15%	- 3 075	- 2 465	- 2 024	17 425	13 974	11 471
2 Operating expenses										
1/Labour										
/1 Unskilled	5 900	4 756	3 924	- 50%	- 2 950	- 2 378	- 1 962	2 950	2 378	1 962
/3 Externalities										
2 Operating uses of funds	8 000	9 784	10 963		- 600	- 907	- 1 108	7 400	8 877	9 855
1/Current assets <sup>c</sup>										
/1 Inventories		1 287	2 120	- 20%	-	- 257	- 424		1 030	1 696
2/Fixed assets										
/1 Land and buildings	3 000	3 497	3 843	- 10%	- 300	- 350	- 384	2 700	3 148	3 458
/2 Equipment	3 000	3 000	3 000	- 10%	- 300	- 300	- 300	2 700	2 700	2 700
2 Net cash flow—financial										
1 Sources										
1/Equity	7 000	7 000	7 000					7 000	7 000	7 000
2 Uses										
1/Debt service										
/1 Interest	1 400	1 138	947	35%	490	398	331	1 890	1 536	1 278
2/Taxes	900	706	567	- 100%	- 900	- 706	- 567	-	-	-
3/Dividends	900	676	521	- 100%	- 900	- 676	- 521	-	-	-

<sup>a</sup>Except for total and subtotal lines, only lines containing values that must be adjusted have been shown here for emphasis. The line "net cash flow—physical" carries totals because it reflects the cash flow related to expenditures on physical inputs and revenues from the sale of output from the operation. This line, once adjusted, provides the data necessary for calculating the economic rate of return. The line "net cash flow—financial" does not carry totals, because the only items of interest in this section are those affecting the distribution of income, the total is irrelevant here.

<sup>b</sup>The economic adjustment factors used here are hypothetical, but reflect a rather typical situation. The market value of output and inputs exceed by 20 per cent and 15 per cent, respectively, their trading opportunity (border) costs, which are assumed to be the relevant source of shadow prices in this instance. Unskilled labour is overpriced in the market by 50 per cent. The cash and receivables of the project do not reflect employment of "real" resources and, therefore, exceed their shadow prices by 100 per cent. Fixed assets are overpriced because of excess costs of labour in the construction and moderate duties on the imported equipment. In an actual analysis, the assumptions behind adjustment factors should be well documented on additional pages.

<sup>c</sup>Since current assets are recovered in full at the end of the project, there is a zero present value cost for them at a zero discount rate. However, as these assets were recovered several years after the original investment, they involve a positive financial cost at non zero discount rates. In economic terms only inventories involve real resources and thus real economic costs.

TABLE 11. ADJUSTMENT TO CASH FLOW: FOREIGN EXCHANGE

Item	Preliminary adjusted present value			Foreign exchange adjustment <sup>a</sup>						Stage two present value		
	0%	10%	20%	Content	Premium	Weighted premium	0%	10%	20%	0%	10%	20%
1. Net cash flow—real	4 125	301	- 2 372	—	10%	—	3 630	2 778	2 166	7 755	3 079	- 205
.1. Operating sources of funds	11 525	9 178	7 483	—	10%	—	3 900	3 130	2 572	15 425	12 309	10 055
.1/Operating profit before interest or tax)												
/1. Production	63 200	50 801	41 796	100%	10%	10%	6 320	5 080	4 180	69 520	55 881	45 976
/2. Costs												
.1. Materials												
.1/Imported	18 700	15 128	12 524	100%	10%	10%	1 870	1 513	1 252	20 570	16 641	13 776
.2/Domestic	17 425	13 974	11 471	31%	10%	3%	550	437	356	17 975	14 411	11 826
.2. Operating expenses												
.1/Labour												
/1. Unskilled	2 950	2 378	1 962	—	10%	—	—	—	—	2 950	2 378	1 962
.2. Operating uses of funds	7 400	8 877	9 855	...	...	...	270	352	406	7 670	9 230	10 260
.1/Current assets												
/1. Inventories	...	1 030	1 696	80%	10%	8%	—	82	136	...	1 112	1 832
.2/Fixed assets												
/1. Land and buildings	2 700	3 148	3 458	—	10%	—	—	—	—	2 700	3 148	3 458
/2. Equipment	2 700	2 700	2 700	100%	10%	10%	270	270	270	2 970	2 970	2 970
2. Net cash flow—financial <sup>b</sup>												
.1. Sources												
.1/Equity	7 000	7 000	7 000	40%	10%	4%	280	280	280	7 280	7 280	7 280
.2. Uses												
.1/Debt service												
/1. Interest	1 890	1 536	1 278	—	10%	—	—	—	—	1 890	1 536	1 278
.2/Taxes	—	—	—	—	—	—	—	—	—	—	—	—
.3/Dividends	—	—	—	50%	10%	5%	45	34	26	45	34	26

<sup>a</sup>The foreign exchange adjustment factors used here are hypothetical, but are based on the assumption that, in the country of the project, foreign exchange is undervalued by 10 per cent at market exchange rates. The weighted adjustment factor depends on the tradable contents of each item. Theoretically all tradable items should be listed separately so that the full 10 per cent premium, for example, could be applied. *In practice*, it is usually sufficient to estimate the tradable contents in each category and multiply the foreign exchange premium by this fraction to get a weighted adjustment factor. The weighted foreign exchange adjustment factor must be applied to economic rather than market values, for the former reflect the border value of the tradable commodities; the economic adjustment at each discount rate therefore must be subtracted from the financial net present value before applying the weighted foreign exchange adjustment factors. The zero foreign exchange content of labour expenses is only hypothetical and should not be interpreted as an assumption in this *Guide* that there is no foreign exchange content in labour, for any additional consumption by labour induced by the project may have such content, which should be reflected accordingly.

<sup>b</sup>Adjustments in this portion of the table are based on original, unadjusted financial values.



TABLE 12 INCOME-FLOW ANALYSIS

Item	Adjustment		Group					
	Economic and financial	Foreign exchange	Project	Other private business	Government	Workers	Consumers	External
A (Values at 0 per cent discount rate)								
1 Net cash flow—real								
1 Operating sources of funds								
1/Operating profit (BITD) <sup>a</sup>								
/1 Production value	- 15 800	6 320	9 480				- 9 480	
/2 Costs								
1 Materials								
1/Imported	- 3 300	1 870	- 1 430		1 430			
2/Domestic	- 3 075	550	- 2 525	2 525				
2 Operating expenses								
1/Labour								
/1 Unskilled	- 2 950		- 2 950			2 950		
2 Operating uses of funds								
1/Current assets								
/1 Inventories								
2/Fixed assets								
/1 Land and buildings	- 300		- 300	150		150		
/2 Equipment	- 300	270	- 30	15		15		
2 Net cash flow—financial								
1 Sources								
1/Equity		280	280					- 280
2 Uses								
1/Debt service								
/1 Interest	490		490		- 490			
2/Taxes	- 900		- 900		900			
2/Dividends	- 900	45	- 855		- 45			900
3 Net distribution impact			1 260	2 690	1 795	3 115	- 9 480	620
B (Values at 10 per cent discount rate <sup>b</sup> )								
Net distribution impact			834	2 254	1 569	2 567	- 7 620	396
C (Values at 20 per cent discount rate <sup>b</sup> )								
Net distribution impact			528	1 933	1 399	2 169	- 6 270	241

<sup>a</sup>Before interest, tax or depreciation<sup>b</sup>Values at 10 per cent and 20 per cent discount rates were derived in the same way as those shown at 0 per cent, but the details have been omitted

TABLE 13 ECONOMIC VALUE OF SAVINGS

	Savings impact			Valuation		Best estimate		
	Income impact (1)	MPS (2)	Impact (3)	Net impact (4)	Adjustment factor <sup>a</sup> (5)	Impact value (6)	Adjustment factor (7)	Adjustment value <sup>b</sup> (8)
At 0 per cent								
Project	1 260	0.5	630	} 520	{ 6.0	3 120	1.8	936
Rest of private sector	2 690	0.5	1 345					
Government	1 795	0.6	1 077					
Workers	3 115	0.1	312					
Consumers	- 9 480	0.3	- 2 844					
External sector	620	-	-					
At 10 per cent								
Project	834	0.5	417	} 456	{ 6.0	2 736	1.8	820
Rest of private sector	2 254	0.5	1 127					
Government	1 569	0.6	941					
Workers	2 567	0.1	257					
Consumers	- 7 620	0.3	- 2 286					
External sector	396	-	-					
At 20 per cent								
Project	528	0.5	264	} 35	{ 6.0	210	1.8	63
Rest of private sector	1 193	0.5	596					
Government	1 399	0.6	839					
Workers	2 169	0.1	217					
Consumers	- 6 270	0.3	- 1 881					
External sector	241	-	-					

<sup>a</sup>These three alternative adjustment factors for savings were calculated according to the formula given on p. 65 using the following percentage values

Marginal propensity to save (MPS) 30  
 Marginal productivity of capital (MPCap) 25  
 Consumption rate of interest (CRI) 10 ↔ 13 ↔ and 16

The three different CRIs were used because the CRI is treated as an unknown variable in the UNIDO method, one that must be determined through an iterative discussion between decision makers at the top and analysts at the bottom

<sup>b</sup>Probabilities assigned to savings adjustment factors are as follows

Factor	Probability	Best estimate
6.0	10%	} 1.8
2.2	20%	
1.1	70%	

TABLE 14. INCOME-DISTRIBUTION WEIGHTS

Group	Per capita consumption	Ratio of consumption to base level	Weight			Adjustment factor <sup>a</sup>		
			n =			n =		
			0	1	2	0	1	2
Project	10 000	2.0	1.0	0.5	0.25	0	- 0.50	- 0.75
Other private business	10 000	2.0	1.0	0.5	0.25	0	- 0.50	- 0.75
Government	Base level	1.0	1.0	1.0	1.00	0	0	0
Workers	1 000	0.2	1.0	5.0	25.00	0	+ 4.00	+ 24.0
Consumers (Base level)	5 000	1.0	1.0	1.0	1.00	0	0	0
External sector	∞	∞	0.0	0.0	0.00	- 1.00	- 1.00	- 1.00

<sup>a</sup>Equal to weight minus 1.0 and expressed as percentage.

TABLE 15 INCOME-DISTRIBUTION IMPACT VALUE

Discount rates/groups	Income impact (1)	Distribution adjustment factor <sup>a</sup>			Distribution adjustment value			Best estimate <sup>b</sup>	
		n = 0 (2)	n = 1 (3)	n = 2 (4)	n = 0 (5)	n = 1 (6)	n = 2 (7)	Adjustment factor (8)	Adjustment value (9)
At 0 per cent discount rate									
Project	1 260	—	- 0.5	- 0.75	—	- 630	- 945	- 0.215	- 271
Rest of private sector	2 690	—	- 0.5	- 0.75	—	- 1 345	- 2 017	- 0.215	- 578
Government	1 795	—	—	—	—	—	—	—	—
Workers	3 115	—	4.0	24.00	—	12 460	74 670	1.760	5 482
Consumers	- 9 480	—	—	—	—	—	—	—	—
External sector	620	- 1.0	- 1.0	- 1.00	- 620	- 620	- 620	- 1.000	- 620
Net	—	—	—	—	- 620	9 865	71 088	—	4 013
At 10 per cent discount rate									
Project	834	—	- 0.5	- 0.75	—	- 417	- 626	- 0.215	- 179
Rest of private sector	2 254	—	- 0.5	- 0.75	—	- 1 127	- 1 690	- 0.215	485
Government	1 569	—	—	—	—	—	—	—	—
Workers	2 567	—	4.0	24.00	—	10 268	61 608	1.760	4 518
Consumers	- 7 620	—	—	—	—	—	—	—	—
External sector	396	- 1.0	- 1.0	- 1.00	- 396	- 396	- 396	- 1.000	- 396
Net	—	—	—	—	- 396	8 328	58 896	—	3 458
At 20 per cent discount rate									
Project	528	—	- 0.5	- 0.75	—	- 264	- 396	- 0.215	114
Rest of private sector	1 933	—	- 0.5	- 0.75	—	- 966	- 1 450	- 0.215	- 416
Government	1 399	—	—	—	—	—	—	—	—
Workers	2 169	—	4.0	24.00	—	8 676	52 056	1.760	3 817
Consumers	- 6 270	—	—	—	—	—	—	—	—
External sector	241	- 1.0	- 1.0	- 1.00	- 241	- 241	- 241	- 1.000	- 241
Net	—	—	—	—	- 241	7 205	49 969	—	3 046

<sup>a</sup>n = elasticity of the marginal utility of income.

<sup>b</sup>Based on the following probabilities with respect to n

n	Probability	Best estimate n = 0.35
0	0.70	
1	0.25	
2	0.05	

TABLE 16. PROJECT SUMMARY MATRIX

## A. Quantifiable aspects

Item	Adjust- ment	Present value			Internal rate of return (%)
		0%	10%	20%	
<i>Stage one—financial analysis</i>					
Financial present value		10 000	4 581	773	22
Impact of a 10% increase in material costs on benefits					
Adjustment		4 250	3 424	2 823	
Adjusted values		5 750	1 157	- 2 050	13
<i>Stage two—economic analysis</i>					
Economic adjustments		- 5 875	- 4 280	- 3 144	
Preliminary economic values		4 125	301	- 2 371	11
Foreign exchange adjustments		3 630	2 778	2 166	
Economic values		7 755	3 079	- 205	19
Adjustments					
Output	- 20%				
Materials	- 15%				
Unskilled labour	- 50%				
Foreign exchange	10%				
<i>Stage three—savings analysis</i>					
Savings impact	180%	936	820	63	
Adjusted values		8 691	3 899	- 142	20
<i>Stage four—income-distribution analysis</i>					
Income-distribution adjustment (based on $n = 0.35$ )		4 013	3 458	3 046	
Income-distribution adjusted values		12 704	7 357	2 904	24
<i>Stage five—merits and demerits<sup>a</sup></i>					
Adjustments					
Industrialization (value added)	2%	619	497	407	
Use of petroleum (petroleum inputs)	- 10%	- 385	- 310	- 256	
Generation of employment (wages)	3%	271	219	180	
Total		505	406	331	
Adjusted values		13 209	7 763	3 235	29

<sup>a</sup>Items in parentheses indicate the value to which the adjustment factor is applied.

## B. Qualitative aspects

Aspect	Comments
<i>Stage one—financial analysis</i>	
Managerial quality	Managers are able but somewhat inexperienced; management needs strengthening at the middle levels.
Market potential	Market will depend heavily on implementation of government agricultural credit programme and on completion of irrigation scheme in north-west.

TABLE 16 B (continued)

Aspects	Comments
<i>Stage two—economic analysis</i>	
Economic impact	Project will relieve agricultural production bottle-neck by producing tractors currently in short supply owing to foreign exchange scarcity (value of imported content of tractors produced by project will be less than 30% of cost of imported tractors).
Production efficiency	Project will have good economic rate of return, indicating efficiency of production; however, domestic materials will be procured at relatively high cost owing to monopoly positions of present local producers of inputs; steps should be taken to lower protection to these producers.
<i>Stage three—savings analysis</i>	
Impact of project	Impact will be positive but marginal; net increase in savings induced will equal less than 10% of the present value of the project investment at a 10% discount rate.
<i>Stage four—income-distribution analysis</i>	
Gains and losses	All groups, including the project, will gain at the expense of the consumers, who will pay an inflated price for their tractors. The largest gainers will be the private businessmen, who will gain by selling inputs to the project at inflated prices, and the unskilled workers, who will receive wages equal to the shadow value.
<i>Stage five—merits and demerits</i>	
Industrialization	Project is consistent with the country's policy of developing efficient heavy industry.
Use of petroleum	A charge has been placed against the project's use of petroleum in addition to the shadow price of this input because the country is seeking independence from foreign oil producers. Both project and finished tractors will increase petroleum consumption.
Generation of employment	Project will offer employment to 5,000 workers in a region with high unemployment and considerable social and political unrest.
Environment	Project located in industrial zone in urban area; some negative impact in terms of noise and congestion. Excellent design eliminates problems of air and water pollution.
Basic needs	The impact of the project on provision of basic needs is indirect and can not be quantified. However, the light tractors should increase production and lower cost of basic food grains for poor in target areas.

## Annex II

### NET-PRESENT-VALUE MANIPULATION

It was suggested in chapter II that correcting distortions by applying an adjustment factor to present values is equivalent to the traditional approach of applying a conversion factor to annual (current) values. This annex proves that conversion factors may be used with equal validity on either the annual or present values, then demonstrates the equivalence of adjustment and conversion factors.

#### Application of conversion factor

Start with the basic equation

$$NPV_j = \sum_{i=1}^n d_i f_{i,j} \quad (1)$$

where  $NPV_j$  is the financial net present value over  $n$  years of input or output  $j$ ;  $d_i$  is the discount factor at the appropriate rate of interest for values in year  $i$ , and  $f_{i,j}$  is the value in year  $i$  of input or output  $j$ . From this it is clear that the financial net present value (NPV) for a project as a whole with  $m$  inputs and outputs is

$$NPV = \sum_{j=1}^m NPV_j = \sum_{j=1}^m \sum_{i=1}^n d_i f_{i,j} \quad (2)$$

The economic net present value  $\overline{NPV}_j$  of input or output  $i$  for which the conversion factor is  $c_j$  is

$$\overline{NPV}_j = \sum_{i=1}^n c_j d_i f_{i,j} \quad (3)$$

If the conversion factor  $c_j$  is constant over time, (3) may be rewritten as

$$\overline{NPV}_j = c_j \sum_{i=1}^n d_i f_{i,j} \quad (4)$$

Equations (3) and (4) show that the conversion factor may be applied either to the individual yearly values or to the net present value of each input and output.

#### Equivalence of conversion and adjustment factors

Continuing from (4), it is clear that for the entire project the economic net present value is

$$\overline{NPV} = \sum_{j=1}^m c_j \sum_{i=1}^n d_i f_{i,j} \quad (5)$$

Substituting from (1) to (5),

$$\overline{NPV} = \sum_{j=1}^m [c_j NPV_j] \quad (6)$$

Since  $NPV_j - NPV_j = 0$  we can write:

$$\overline{NPV} = \sum_{j=1}^m [c_j NPV_j + NPV_j - NPV_j] \quad (7)$$

Factoring out  $NPV_j$  gives:

$$\overline{NPV} = \sum_{j=1}^m [NPV_j (c_j - 1) + NPV_j] \quad (8)$$

In turn, given (2),

$$\overline{NPV} = NPV + \sum_{j=1}^m [(c_j - 1) NPV_j] \quad (9)$$

Since we have made the following definitions:

$$a_j \equiv c_j - 1 \quad (10)$$

we may write (9) as

$$\overline{NPV} = NPV + \sum_{j=1}^m a_j NPV_j \quad (11)$$

The above proves the equivalence of the conversion-factor and adjustment-factor approaches. The additive nature of the adjustment-factor approach can be seen more clearly, however, if we define the economic adjustment  $e_j$  as follows:

$$e_j \equiv a_j NPV_j \quad (12)$$

i.e., the economic adjustment in the product of the adjustment factor and the net present value of the input or output and reflects the premium or discount required to move from financial to economic value.

Substituting (12) into (11) gives

$$\overline{NPV} = NPV + \sum_{j=1}^m e_j \quad (13)$$

that is, the economic net present value of the project is equal to its financial net present value plus the sum of any adjustments that were required.

If the market and economic price of an input or an output are the same, the conversion factor will, of course, be equal to 1.0 and by (10) the adjustment factor  $a_j$  will be equal to zero. A zero adjustment factor will by (12) produce a zero economic adjustment and, as can be seen by (13), any zero economic adjustments can simply be ignored in calculating the project's economic net present value. Herein lies the advantage of the adjustment-factor over the conversion-factor approach. With the adjustment-factor approach, it is possible to concentrate solely on the differences between financial and economic values. With the conversion-factor approach, however, it is necessary to work again with each of the inputs and outputs, even though the conversion factor may be unity, as is seen in (6). While no theoretical advantage can be claimed for the adjustment-factor approach, it does make the calculation easier.



### Annex III

#### THE ELASTICITY OF THE MARGINAL UTILITY OF INCOME

Although it has only been mentioned in passing in this book, the elasticity of the marginal utility of income  $n$  is a vital concept underlying the entire discussion in this *Guide*, especially that of stages three and four. It is the link between three important numbers: the consumption rate of interest, the premium on savings and the income-distribution weight.

The formula for the consumption rate of interest

$$\text{CRI} = ng + p \quad (1)$$

indicates that the CRI rises with the value of the elasticity of the marginal utility of income; given an annual rate of growth of *per capita* income  $g$ , the CRI will be higher with higher values of  $n$  (higher values of  $n$  indicate greater rates of decline in the value of additional income). Conversely, faster rates of *per capita* income growth will mean less value on future income, and a higher CRI. A more intuitive explanation for the relationship is that since increased *per capita* incomes make people in the future richer than people today, and since it is normally assumed that income going to the "rich" is less valuable than that going to the "poor", the faster people get rich (a function of  $g$ ) and the higher the discount as income levels rise (a function of  $n$ ), the less is the value or weight that will be assigned to their future income. The  $p$  factor reflects the fact that people do not like to wait until tomorrow to consume what they might today.

The formula for the premium on savings

$$\text{AF}_s = \left[ \frac{\text{MPC}(\text{MP}^{\text{cap}})}{\text{CRI} - \text{MP}^{\text{cap}}(\text{MPS})} \right] - 1 \quad (2)$$

reveals that, since the adjustment factor for savings ( $\text{AF}_s$ ) is also a function of the CRI, and since the CRI in turn depends on  $n$ , the premium on savings also depends on the value of the elasticity of the marginal utility of income.

Finally, the income-distribution weights also depend on the elasticity of the marginal utility of income  $n$ . Income at the  $c_i$  level of the *per capita* consumption has a weight of  $w_i$  compared with that at the base level of consumption  $b$  that has a weight of 1. These weights are calculated according to the formula:

$$w_i = \left( \frac{b}{c_i} \right)^n \quad (3)$$

While these interrelations are quite clear from a theoretical point of view, it is difficult to obtain a consistent set of values for CRI,  $\text{AF}_s$  and the income-distribution weights because it is virtually impossible to derive empirically the elasticity of marginal income utility that lies behind each. Thus, at the risk of theoretical inconsistencies, the *Guidelines* recommends that these be derived individually through "bottom-up" sensitivity testing, modified as necessary to obtain consistency with "top-down" instructions from the central planners or social decision makers. In other words, an iterative process of trial and error is required because the role of  $n$  cannot be measured directly.



## Glossary

### COMMON TERMS IN ECONOMIC PROJECT EVALUATION

This glossary is designed to provide short definitions of economic terms used regularly in project evaluation. It is not designed to teach economics, nor is it designed to explore all the conditions and complications that the theoretical economist might wish to consider.

The words in bold face used in the definitions are themselves defined in this glossary.

*accounting price.* A term often used synonymously with **shadow price**. The term "accounting" indicates that the price is not a **market price**. Accounting prices reflect, for example, the **economic value of inputs and outputs** as opposed to their **financial** or market value. The accounting price will depend heavily on the unit of account, or *numéraire*.

*accounting rate of interest.* The **discount rate** used to convert future values of benefits and costs expressed in the chosen unit of account or *numéraire* into equivalent present values in the same *numéraire*. If consumption is the *numéraire* (UNIDO method), the accounting rate of interest is the fall in the value of consumption over time, the consumption rate of interest. If investment is the *numéraire* (Little-Mirrlees method), it is the fall in the value of investment over time, the **marginal productivity of capital**, often known also as the **opportunity cost of capital**. Accounting rates of interest become more complex when the *numéraire* takes other factors into consideration (e.g. value of public revenues or social income in revised Little-Mirrlees method).

*accounting ratio.* The ratio of the **accounting price** of a good to its **market price** (cf. **standard conversion factor, adjustment factor**).

*accounting rupee.* A *numéraire* reflecting **accounting prices** expressed in a domestic-currency unit such as the peso or the dinar. Used as a shorthand expression in the UNIDO method to refer to **domestic accounting rupee**; used as a shorthand in Little-Mirrlees method for **border accounting rupee**.

*adjustment factor (AF).* The percentage by which the **financial price** of an input or output (e.g. labour) must be raised or lowered to reflect its **economic value**. May be applied to future annual values or to discounted **present values**. Calculated as the ratio of the economic value to the financial value minus unity (see **adjustment value, standard conversion factor**).

*adjustment value.* The amount by which, for example, the financial cost of labour must be adjusted to reflect its **economic value**. The adjustment value is the product of the value to be adjusted and the **adjustment factor**.

*ad valorem.* Expressed as a percentage of value, e.g. a 10 per cent *ad valorem* duty on the c.i.f. price of imported shoes (cf. **specific**).

*annual return on net fixed assets in operation.* A conventional measure of financial profitability: annual profit divided by net fixed assets in operation. Net fixed assets may be defined as those in use at the start of the accounting period at the end or as an average of the two (cf. **internal financial rate of return**).

*appraisal.* Analysis of a proposed project to gauge its acceptability; an *ex ante* concept (cf. **evaluation**).

*asset.* Anything of value, but especially (a) physical assets such as machinery or farm land or (b) monetary assets that can be used to finance the purchase of physical assets; also, the monetary value of the financial or physical capital *per se*, as opposed to the rental value or interest rate for such capital.

*average cost.* The total cost of production divided by the total volume of output.

*balance sheet.* A financial statement listing as of a given date:

(a) Assets of a financial entity (including current assets such as inventories, cash and receivables and fixed assets such as land, buildings and machinery);

(b) Account of the way in which these assets were financed (including liabilities such as accounts payable, suppliers' credits, short- and long-term loans, and net worth such as share capital and retained earnings).

Called a balance sheet because the value of assets must equal the total of liabilities and net worth.

*base level of consumption.* The level of *per capita* private consumption at which an additional rupee of income has the same social value as an additional rupee of government income, as indicated by the fact that the government neither taxes nor subsidizes people at this income level, assuming, of course, that the government's tax/subsidy structure is socially optimal.

*benefit.* Usually refers to the marketed output of a project, or in the case of projects like schools and hospitals, to the major services provided by the project. Other benefits such as foreign exchange savings, worker training, employment generation, and income distribution are generally considered as externalities and are dealt with separately in the appraisal (see **cost, net benefit**).

*benefit-cost analysis.* A procedure for evaluating the desirability of a project by weighing benefits against costs. Results may be expressed in many ways, including **internal rate of return, net present value and benefit-cost ratio**. Financial profitability is a type of benefit-cost analysis, but does not provide a sufficient measure of a project's net return to the economy in situations where the market prices used do not reflect the true economic value of the inputs and outputs. In such instances, economic benefit-cost analysis using **accounting prices** is required.

*benefit-cost ratio.* The ratio of **benefits** to **costs**. It should be calculated using the present values of each, discounted at an appropriate **accounting rate of interest**. The ratio should be at least 1.0 for the project to be acceptable. Inconsistent benefit-cost ratios may arise, since they are calculated in various ways, including:

(a) **Present value** of all positive **cash flows** divided by present value of all negative cash flows (both on annual basis);

(b) Present value of gross benefits from each year divided by present value of annual costs, including investment;

(c) Present value of net annual operating benefits over present value of investment costs (see **discounting, internal rate of return, discounted cash flow**).

*book value.* The value of an asset as recorded in the operation's financial account books. May be either gross book value (usually the original cost) or net book value (the gross book value minus accumulated depreciation) (cf. **replacement value**). In some cases, the gross book value may be adjusted for inflation, which is highly desirable in an inflationary environment.

*border accounting rupee.* The *numéraire* used in the Little-Mirrlees method of economic project evaluation. Reflects the economic value of **inputs and outputs** "at the border", i.e. in **border prices** converted from dollars into rupees at the official exchange rate (cf. **domestic accounting rupee; see accounting rupee**).

*border price.* The price of a *tradable* good at a country's border or port of entry. For exports, the f.o.b. price, for imports, the c.i.f. price. Provides a measure of **economic opportunity cost**. May be expressed in **dollars** or in **border accounting rupees**. Should include **internal importing costs** or savings such as the cost of transport from port of entry to market if significantly different from factory-to-market transport costs and the cost of maintaining extra inventories required to cover delays in international shipments compared with shipments from local sources.

*border rupee.* See **border accounting rupee**.

*break-even point.* Normally, the point in terms of volume of sales after which revenues exceed **fixed plus variable costs**. After the break-even point, each additional item sold generates a "profit". (Note that it is a **financial** rather than an **economic** concept; the "profit" must also cover the **opportunity cost of capital** before "economic profit" is realized; see **profit**.)

*Bruno ratio.* Also known as the **domestic cost of saving a unit of foreign exchange**. The ratio of the cost of domestic resources (e.g. labour, materials, **capital**) used by a project to the foreign exchange saved. If domestic resources are expressed in domestic currency and foreign exchange is expressed in **dollars**, a Bruno ratio of less than the (shadow) **exchange rate** is considered quite acceptable. If both domestic resources and foreign exchange are expressed in the same currency, a ratio of 1.0 is the nominal cut-off point. Ratios higher than 1.0 or greater than the exchange rate imply that protection is required for the project to survive. As a one-year measure, the most common form in which it is calculated, it is inferior to the **internal economic rate of return**.

*capital.* Resources that will yield **benefits** gradually over time. Related to investment and in contrast to consumption. May be divided into **physical** and **financial**, into **fixed** and **working** etc. Sometimes defined more broadly to include **human capital**, e.g. an education that yields benefits over time.

*capitalized value.* The amount of **capital** that would be required today to yield a flow of **benefits** equal, in terms of **present value**, to those expected from a project, discounted at a rate equal to the **opportunity cost of capital**.

*cash flow.* The disposable funds or cash generated by the project after investment costs, materials, labour, utilities and other basic expenses have been met. This cash may be applied to interest payments, taxes, debt amortization, dividends or be retained by the project. Cash flow is usually calculated on a yearly basis for purposes of project analysis, but may be done in great detail on a weekly or monthly basis for the financial management of a project after it has begun operations. To be technically correct, it would be better to use the term "*fund flow*" in connection with project evaluation (cf. **fund flow**; see **discounted cash flow**, **internal rate of return**).

*cash-flow statement.* A financial statement that records the cash flow of a project or financial entity. Frequently referred to as the "sources-and-uses-of-funds" statement. Customarily divided into "sources of funds" (cash flow from operating profits and depreciation, borrowing, equity etc.) and "uses of funds" (capital investments, taxes, interest, debt amortization, dividends etc.).

*c.i.f.* Cost, insurance, freight; the **border price** of an import that includes purchase cost abroad and charges the international freight and insurance necessary to bring it to the port of entry and to unload it on the dock alongside the ship.

*comparative advantage.* The principle that, since every country produces some things more efficiently than others it will be better off if it specializes in those items it produces most efficiently, exporting them and importing those it does not produce as efficiently.

*compound growth.* A method of calculating growth over a period of time which yields the percentage rate required to grow from initial value to final value at a constant compounding rate. (Compounding means that growth for a given year is calculated including all growth in the previous year; e.g. at 10 per cent compound growth, 100 would grow to 110, 121, 133, 146 etc.)

*constant price.* Price from which the effects of inflation have been removed. Price that has been deflated to "real" terms by an appropriate price index based on prices that prevailed at a certain date (e.g. 1960) and on price increases since that time (cf. *current price*).

*consumer surplus.* The value consumers receive over and above what they actually have to pay. For example, if car buyers were asked how much they would be willing to pay, some who needed a car desperately might be willing to pay \$5,000, while others might be willing to pay only the market price of \$3,500, and so on down to the consumer who would be willing to pay only, say, \$2,000. Since every consumer pays only \$3,500, those who would have been willing to pay more enjoy a "surplus".

*consumer willingness to pay.* What consumers are willing to pay for a good or service. Depending on how badly they want it, some consumers may be willing to pay substantially more than the actual market price, in which case they enjoy a consumer surplus (see *consumer surplus*).

*consumption rate of interest (CRI).* The rate at which the value of a rupee destined for consumption falls over time. Usually expressed as an annual percentage rate of decline. Usually considered to depend on two compound factors:

(a) Rate of growth of *per capita* income and the elasticity of the marginal utility of income, since if people are richer in the future, the additional rupee of consumption will not mean as much to them;

(b) Pure time preference, a percentage measure of the premium people attach to enjoying things today instead of a year from now, even if their income stays the same.

*convertible foreign exchange.* Foreign exchange that can be converted without restrictions into any of the major international currencies.

*conversion factor.* See *standard conversion factor, accounting ratio*.

*cost.* (a)—as opposed to *benefit*. An expense related to purchase of inputs, including capital equipment, buildings, materials, labour and public utilities. Costs such as despoiling the environment and injuries to workers' health, since they fall outside the financial accounts of the project, are generally regarded as *externalities* and dealt with separately; (b)—as opposed to *value*. The amount of resources used to produce a good (a supply-side concept, e.g. "domestically it would cost \$10 to produce this wrench, but its value is only \$8").

*cost-of-living index.* A price index that reflects changes in the cost of living as these are measured by the relative money cost at different dates of a fixed group or "basket" of goods and services representative of those on which an average person would spend his income.

*cost-benefit analysis.* See *benefit-cost analysis*.

*cross-over discount rate.* The discount rate that equalizes the net present value of two streams of benefits and/or costs. Usually applied to cost streams reflecting mutually exclusive alternative project designs. Also known as an equalizing discount rate. At either side of the discount rate, the relative ranking of the alternatives reverses (see *switching value*).

- current inputs.* Inputs into production that are not capital inputs, that is, inputs such as labour and materials that are purchased throughout the life of the project on a current basis, inputs that do not yield their value over an extended period after a one-time investment as does a machine.
- current price.* Price that includes the effects of inflation or deflation. Price as actually observed (cf. **constant price**).
- cut-off rate.* The rate of interest (commonly the **opportunity cost of capital** or the **accounting rate of interest**, Little-Mirrlees method, or the **consumption rate of interest**, UNIDO method) below which capital investment projects should be rejected. Often thought to be in the range of 8-12 per cent, but it could vary more widely depending on the circumstances and the *numéraire*.
- deflation.* (a) The process of reducing values from **current prices**, which reflect **inflation**, to **constant prices**, from which the effects of inflation have been removed; (b) A general reduction in market-price levels (current unit prices go down—the opposite of inflation).
- demand.* Need or desire for a good or service. Since the need will vary depending on the person, the price and the circumstances, demand is usually expressed in terms of the quantities that would be demanded at various prices. The resulting “demand curve” usually slopes downwards, indicating that people will demand more at lower prices than at higher prices (cf. **supply**).
- depreciation.* The allocation of the cost of an **asset** over time. This is necessary for a working estimate of production costs; but since rates of depreciation are usually determined primarily by legal and accounting requirements, the amount of depreciation often bears limited relationship to the actual rate of use or cost of replacement.
- direct tax.* A tax on income or net profit, as opposed to an **indirect tax**, which falls on the output (e.g. an excise tax) or on an input (e.g. a pay-roll tax).
- discount rate.* The interest rate at which future values are discounted to the present. Usually considered roughly equal to the **opportunity cost of capital**. The discount rate must, however, be commensurate with the *numéraire*; for example, in the UNIDO method, the discount rate is the **consumption rate of interest** because consumption is used as the *numéraire*. In the Little-Mirrlees method, on the other hand, the productivity of public income is used as the discount rate because public income is the *numéraire*. (Note: the definitions of both of these discount rates and the corresponding *numéraires* have been greatly simplified in this explanation.)
- discounted cash flow (DCF).* A type of analysis based on discounting cash flows to the present by a given discount rate. Allows an analyst to take into account the fact that a **dollar of benefit** received a year from today is not as valuable as a dollar of **cost** incurred today, for example, because if the cost had not been incurred, the dollar could have been invested, and in a year's time at an interest rate of, say 10 per cent, the capital would have grown to \$1.10. Because projects vary widely in the pattern of their costs and benefits over time, DCF is necessary to place them on a common **present-value** basis for comparison.
- discounting.* The process of adjusting future values to the present by a **discount rate**. This procedure recognizes that, for example, a smaller amount invested today at the discount rate would grow to a larger future **value** over time; therefore, the amount received in the future is worth only the smaller value today. The discount rate depends on the *numéraire*, for example, the *numéraire* in the UNIDO method is consumption, so the discount rate is the **consumption rate of interest**, which also reflects the fall in value of amounts received in the future. If

$d$  is the discount rate by which the value  $V_t$  in year  $t$  must be discounted to yield the present value  $V_0$ , the formula is

$$V_0 = V_t \left[ \frac{1}{(1+r)^t} \right]$$

*distortion.* A difference between actual *market* and *economic prices*. For example, if the market wage rate for unskilled labour is Rs 10 per day while, owing to widespread unemployment, the economic price is only Rs 2 per day, a distortion of Rs 8 per day exists. Such distortions are important for two major reasons. First, they can distort the choice of technique, leading in this case, for example, to production methods that require less labour because of labour's relatively high cost. Secondly, distortions are the mechanism that distributes to factors such as labour income over and above their *opportunity cost* (e.g. labour receives Rs 8 more income than if it had been paid its economic price). Distortions are not necessarily bad, for the distortion is only with respect to economic efficiency. With respect to social equity it may be entirely desirable to have, for example, a market wage Rs 8 higher than the economic price of labour.

*distributional gain or loss.* See *incremental income flow*.

*dollar.* A general term for freely convertible international currencies such as the United States dollar or the Swiss franc (cf. *rupee*).

*domestic accounting rupee.* The *numéraire* used in the UNIDO method of economic project evaluation. ("Rupee" is a general term for any domestic currency; it could just as well be accounting peso or dinar.) Domestic accounting rupees differ from *border accounting rupees* in that they include the average distortion between *border* and *market prices*. They reflect the percentage difference between the official and *shadow exchange rates*. Border rupee values plus the premium on *foreign exchange* become domestic accounting rupee values. Domestic accounting rupees differ from *market rupees* in that they measure *economic* rather than *financial* values.

*domestic resource cost.* The cost of resources used in production that are not imported. Often used in connection with the domestic cost of saving a unit of foreign exchange measure or *Bruno ratio*.

*domestic value added.* Output cost in domestic prices minus cost of material inputs at domestic prices (see *effective protection*—*Balassa and Corden measures*).

*duty.* A tariff or tax collected on imported goods at the port of entry. Sometimes applied to exports as well. May be *specific* (Rs/ton) or *ad valorem* (percentage). As distinct from an *excise tax*, which is applied on all goods whether imported or produced domestically.

*economic.* Having to do with the national economy, especially as in "economic value". The value of a good or service to the country as a whole (excluding income-distribution considerations), as opposed to its private or commercial value.

*economic price.* Synonymous with *efficiency price*. Price that reflects the relative value that should be assigned to *inputs* and *outputs* if the economy is to produce the maximum value of *physical output* efficiently. There is no consideration of income distribution or other "non-efficiency" goals in such a price (cf. *market price*, *social price*).

*economic rate of return.* More completely known as the *internal economic rate of return*. An *internal rate of return* based on *economic prices*.



*economies of scale.* Usually describes situations in which the investment cost per unit of production drops as the plant capacity is increased. May also refer to **operational costs**.

*effective exchange rate.* The domestic market (**rupee**) price of a good divided by its **border (dollar) price**. In effect, the exchange rate actually paid for a given good. Serves as an estimate of the **shadow exchange rate** for that good.

*effective protection.* Protection through import duties etc. as related to domestic **value added** as opposed to total value of **output**. Commonly measured as the excess value added. Effective protection measures the protection given to the production process *per se*, not just to the product. Often useful as a partial, quick indicator of economic acceptability. Closely related to the **Bruno ratio**. It is normally an "average-year" test and being a static measure, does not reflect the **opportunity cost of capital**, the time value of money.

*effective protection—Balassa and Corden measures.* The **effective-protection** measure commonly associated with the name of Bela Balassa excludes **non-traded inputs** in the calculation of the domestic **value added**, thus limiting it to plant value added, while the effective-protection measure commonly associated with the name of Max Corden includes such non-traded inputs.

*efficiency price.* See **economic price**.

*elasticity.* A measure of the responsiveness of one factor to changes in another; the ratio of the percentage by which one factor changes, given a 1 per cent change in another. For example, if demand goes down by 2 per cent when prices go up by 1 per cent, the price elasticity of demand is said to be 2 per cent/1 per cent, or 2.0. (This definition is a simplified compromise between two more conventional definitions: point elasticity is the degree of responsiveness at a given point (e.g. at a price of \$2.04) and is determined by calculus, while arc elasticity is the degree of responsiveness over a broader range (e.g. \$2.00-\$2.25) and may be calculated algebraically.)

*elasticity of the marginal utility of income.* The rate at which the utility of an additional or marginal unit of income declines with increases in the level of income. For example, if the marginal utility of income is considered to decline by 10 per cent with a 10 per cent increase in income, its elasticity  $n$  is equal to 10 per cent/10 per cent, or 1.0. Similarly, if the marginal utility of income is considered to decline by 20 per cent with a 10 per cent increase in income,  $n$  is equal to 20 per cent/10 per cent, or 2.0 (negative signs have been omitted by convention). More generally, if  $b$  is the base level of consumption against which other levels of consumption  $c$  are to be compared, the weight  $w_i$  to be assigned additional consumption made possible for someone at the  $c_i$  level of consumption is

$$w_i = (b/c_i)^n$$

Thus, if the base level of consumption is 100, and  $n = 2$ , additional consumption made possible by the project for someone with a level of consumption of 300 is equal to  $(100/300)^2$ , or 0.11 (see **elasticity, marginal utility of income**).

*equalizing discount rate.* See **cross-over discount rate**.

*equity (a)* In financing and investment, the money contributed directly by the owner(s) and upon which dividends may be paid, as opposed to debt, which is money borrowed by the project that must be repaid and upon which interest is usually charged; *(b)* social justice, as opposed to economic efficiency.

*equivalent value.* An expression used when changing from one *numéraire* to another. If the two *numéraires* are dollars and rupees (\$1.00 = Rs 10.00), for example, the equivalent value of \$5.00 of wheat in rupees is Rs 50. It becomes somewhat less obvious when the *numéraire* is consumption. However, Rs 6,500 is the consumption equivalent of Rs 5,000 of investment if there is a 30 per cent premium on investment over consumption.

*evaluation.* Review of a project's progress either during or after implementation, to determine whether it is being (or was) carried out according to plans and to assess its development impact. An *ex post* concept (cf. **appraisal**).

*exchange rate.* The number of units of domestic currency per unit of international currency (e.g. Rs 10 per dollar). May be expressed in inverse fashion if less than one unit of domestic currency is required to purchase one dollar (e.g. \$2.40 per Sudanese pound) (see **official exchange rate**, **shadow exchange rate**).

*externality.* An impact of a project, good or bad, not reflected in its financial accounts. For example, a project may harm the environment, train workers, or make it easier for other firms to get started in a related line of business, but these effects do not show up in its financial statements. For economic analysis, however, it may be necessary to take such externalities into account and place a value on them if they are significantly out of line with the ordinary impacts of projects in general. (To the extent that projects have equivalent externalities, the costs and benefits of the externalities balance out, and the same projects would be selected.)

*factor, adjustment.* See **adjustment factor**.

*factor cost.* The cost of a good excluding indirect taxes and subsidies (cf. **market price**).

*factor mix.* The share of various factors in the **value added** in producing a product. For example, a labour-intensive factor mix for road building would involve head baskets and hoes; a capital-intensive one would involve bulldozers and trucks. Factor mix is always a relative concept. Labour's share in value added in a labour-intensive cement manufacturing plant might be less than its share in value added in a capital-intensive residential construction project, for example.

*factor of production.* An input into production. Often a distinction is drawn between "primary" factors of production, such as capital, labour and land (including mineral resources), and "secondary" factors of production, such as materials.

*financial.* Having to do with the **market price** (cf. **economic price**, **social price**).

*financial rate of return.* The financial profitability of a project. Usually refers to an **annual return on net fixed assets** or on investment, but may refer to the **internal rate of return**, which is determined through **discounted cash-flow** analysis.

*first-year return.* The profit of the project in the first year of operation divided by the **cost of capital**. If done for several alternative starting years, can be useful in timing initiation of project to maximize rate of return.

*fixed costs.* Costs that must be met, at least in the short term, regardless of production volume, such as management salaries, interest and loan repayments (cf. **variable costs**).

*f.o.b.* Free on board; the price of an export good loaded and ready for departure (see **border price**).

*foreign exchange.* Narrowly, any non-domestic currency. More generally, any **tradable** monetary resource, whether in the form of actual foreign currency, gold, credits in foreign banks etc. Usually implies freely convertible foreign

- exchange, although non-convertible currencies within trading blocs may sometimes be included.
- free foreign exchange.* Freely convertible **foreign exchange** against which there are no pre-emptive claims (e.g. a claim for repayment on foreign exchange that has been borrowed).
- fully traded.* See **traded, fully**.
- fund flow.* An accounting statement showing the sources and uses of funds. Similar to a **cash-flow statement**, except that fund flow generally deals in longer-term flows (e.g. yearly) and with non-cash items such as the issue of new stock.
- gross domestic product (GDP).* The total product or **value added** within the physical borders of the country. It includes production based on foreign-owned resources, even though part of the income earned by these factors of production is transferred abroad as factor service income payments.
- gross national product (GNP).* The total product or value added of the factors of production (**capital** and labour) that belongs to a country's citizens and is in the country at the end of the accounting period. Equal to **GDP** adjusted for the net inflows and outflows of factor service payments such as interest, profits and workers' remittances.
- importable.* An internationally **tradable** good that could be imported.
- incremental.* Additional, in the sense of larger increments; **marginal** in the sense of very small increments.
- incremental income flow.* The additional income lost or gained by any income group (e.g. project, workers, consumers, government) with the implementation of a project owing to **distortions** in market prices that mean that the group either does not receive exactly its shadow value or that it must pay more or less than the shadow value of goods received from the project. Two types of distribution exist, allocation and redistribution. Income gained by a group may represent an allocation of the project's net **profit** or **surplus** over and above earnings required to cover the **opportunity cost of capital**. On the other hand, if the additional income derives from not paying another factor of production its full shadow value, the gain may be called a redistribution of income.
- index number.* Any index calculated to compare an amount in one period with that in another, e.g. growth of production, population (see **price index**).
- indirect tax.* A tax on the output (e.g. excise tax) or one of the inputs (e.g. pay-roll tax). In contrast to **direct tax**, which is on net income.
- inflation.* A general increase in **market-price** levels (current unit prices go up) (cf. **deflation** (b)).
- input.* That which is consumed by the project, as opposed to the project's **output**. Usually refers to the physical inputs used by the project including materials, **capital**, labour and public utilities. Other "inputs" such as environmental quality, **foreign exchange**, and workers' health are usually considered as **externalities**.
- internal economic rate of return (IER).* The **internal rate of return** based on economic as opposed to financial prices (cf. **internal financial rate of return**).
- internal financial rate of return (IFR).* **Internal rate of return** based on financial or market prices (cf. **internal economic rate of return**).
- internal importing costs or benefits.* The economic costs or benefits in addition to the c.i.f. price entailed in importing goods, including, for example, the cost of

transport from port to market *versus* domestic plant to market and the cost of maintaining additional inventories to cover delays and uncertainties of deliveries, whether from domestic suppliers or from abroad.

*internal rate of return (IRR)*. The yield or profitability of a project based on **discounted cash-flow analysis**. The IRR is the **discount rate**, which, when applied to the stream of **benefits and costs** reflected in the **cash flow** of a project, produces a zero net present value.

*least-cost analysis*. A type of analysis commonly used to compare alternative projects or project designs when value of **output (benefits)** cannot be measured adequately (e.g. certain transport projects). If it can be assumed that the (unquantifiable) benefits exceed the cost and if appropriate adjustments are made for any differences in benefits among the alternatives, the task is then to minimize the cost of obtaining them through least-cost analysis. Although **cross-over discount rates** may be generated, a legitimate rate of return cannot be obtained from such analysis, for it is done without reference to the value to users of the output.

*linear programming*. A mathematical procedure to obtain an optimal answer to a series of equations that usually specify:

Resources available

Technological relationships of the production process

Goals (objective function) of the society

Relevant constraints to any solution that is found (in terms of maximum or minimum inputs or outputs).

The solution of such a system of equations through linear programming results in an estimate of the optimal allocation of resources given these objectives and constraints. The "dual solution" provides a set of shadow prices that will allocate resources consistently with this solution, hence the term "shadow prices".

*marginal*. Last, in the sense of the last additional unit.

*marginal benefit*. The value of one more (or one less) unit. (For example, the marginal benefit of the second ton of fertilizer on a hectare is less than that of the first.)

*marginal cost*. The cost of one more (or one less) unit. For example, the marginal production cost of one more ton of steel may be higher than the average cost. This situation is likely if the plant is already at full capacity and must build new capacity. On the other hand, the marginal cost may be lower than the average cost if there is excess capacity that can be utilized and thus reduce the average fixed cost per unit of output.

*marginal investment*. See **marginal productivity of capital**.

*marginal productivity of capital*. The productivity of the last unit of investment that would be undertaken if all investment alternatives were ranked in descending order according to their economic profitability and the available funds were distributed until exhausted. More loosely, the profitability of the marginal project, the project that should receive the last dollar of investment.

*marginal project*. See **marginal productivity of capital**.

*marginal propensity to consume*. The percentage of additional income consumed (cf. average propensity to consume, which is the percentage of total income consumed). Note: the sum of the marginal propensity to consume and the **marginal propensity to save** must equal 1.0.

- marginal propensity to save.* The percentage of additional income saved, as opposed to the average propensity to save, which is the percentage of total income saved (cf. **marginal propensity to consume**).
- marginal revenue.* The revenue generated by the last item sold. Indicates the **marginal economic value** of the product under optimal conditions.
- marginal utility of income.* The value deriving from one more unit of income. This value obviously depends heavily on the present amount of income. It is theoretically impossible to say exactly how much value an additional rupee of income has to any person, but from a practical point of view, policy makers can hold that Rs 1 going to a peasant with a present income of Rs 50 per year has more "utility" than Rs 1 going to a merchant with an income of Rs 50,000 per year (see **elasticity of the marginal utility of income** for a discussion of the rate at which this value is considered to change).
- market exchange rate.* The rate at which foreign currency is bought or sold.
- market price (a)* The price of a good in the domestic market (see **financial**; cf. **economic price**, **world market price**, **border price**, **social price**); *(b)* the cost of a good including indirect taxes and subsidies (cf. **factor cost**).
- market rupee.* A **numéraire**. Any domestic currency that reflects the distortions in the actual domestic market; could just as well be market peso or market escudo (cf. **border rupee**, **accounting rupee**).
- monetary.* Amounts that reflect the prices of physical goods and services rather than the goods and services themselves (see **current price**; cf. **real**, **constant price**).
- mutually exclusive projects.* Project alternatives that cannot be undertaken simultaneously; if one is carried out, the other cannot be. The alternatives may be mutually exclusive because they represent alternative times of beginning the same project, because funds are limited or because if one is carried out the other will not be required (e.g. the choice between a thermal and a hydro power station).
- national parameter.* A **shadow price** or **accounting price** that is the same for all projects in the country. In most cases, the shadow price for foreign exchange and the premium on savings over consumption are national parameters.
- net benefit.* **Benefits minus costs** (see **benefits**, **costs**, **net present value**).
- net present value (NPV).* The net value or **net benefit** of a project when all costs have been discounted to the present at the **accounting rate of interest**. May be positive or negative, but for project to be acceptable, must be either zero or positive (see **present value**).
- net present worth (NPW).* Same as **net present value**.
- nominal protection.* Protection through duties etc., expressed as a percentage of the total price of the product, as opposed to **effective protection**, which is protection as a percentage of the value added.
- non-tradable.* A good that cannot be exported because its domestic cost of production is higher than the export (**f.o.b.**) price but lower than the import (**c.i.f.**) price (e.g. building foundations) (cf. **tradable**).
- non-traded.* A **tradable** good that for economic or policy reasons is neither imported nor exported, or an inherently **non-tradable** good.
- numéraire.* A unit of account, the measure that makes it possible to add and subtract unlike items. For example, apples and oranges, as everyone knows, should not be added up. But if they are expressed in terms of a common **numéraire** such as

“pieces of fruit”, “kilograms” or “dollars”, it is then possible to say, for example, that we have 20 pieces, three kilograms, or \$4 worth of fruit. Similarly, the economic value of a car subject to a 200 per cent duty and selling in the local market for Rs 100,000 is not the same as the economic value of a shipment of cotton to be exported for Rs 100,000. Nor is income in the hands of a rich man necessarily worth the same as that in the hands of a peasant. A common *numéraire* must be specified before these values can be added up. *Numéraires* used in project evaluation are almost always monetary units.

*official exchange rate.* The exchange rate established by the government.

*operational and maintenance costs (O and M).* The recurring costs for operating and maintaining the value of physical assets. Sometimes it is difficult to say whether maintenance costs are current expenditures or capital expenditures, but with **discounted cash flow**, the distinction is unnecessary.

*opportunity cost.* The value of something forgone. For example, the direct opportunity cost of a man-day of labour is what he would otherwise have produced had he not been taken away from his usual occupation to be employed in a project.

*opportunity cost of capital.* The return on assets forgone elsewhere by committing assets to the present project. Expressed as a per cent of the value of **capital**, i.e. as an interest rate. Usually refers to the **marginal productivity of capital**, the return that would otherwise have been produced by the last acceptable project. Often used as a **cut-off rate** for budgeting capital.

*output.* That which is produced. Opposite of **input**. Usually refers to the physical product of the project for which it may receive payment. Other “products” of the project such as housing for workers, employment, training of labour, **foreign exchange savings** etc. are usually regarded as **externalities**.

*payback period.* The period of time required to recover the investment costs of a project out of its **cash flow**. Once fairly widely used as an investment criterion, is now regarded as ineffective because it does not take into account the productive life of the project after it has paid back the original investment cost or the timing of the **costs and benefits**. Useful primarily under conditions of high risk where rapid recovery of **capital** is a prime consideration (cf. **break-even point**).

*present value.* An amount which, taking into account the earning power of **capital** over time and the difference in time between the present and some future date, would be equivalent today to an expenditure or receipt at such a future date; the result of discounting a future **value** to the present by the appropriate **discount rate** (see **net present value**).

*price index.* The market value of a fixed group or “basket” of goods and services at one date (e.g. 1980) divided by the market value of the same basket at some base date (e.g. 1960). Subtracting 1.0 from the index gives the decimal equivalent of the percentage by which prices have increased between the two periods. Useful in measuring rates of **inflation**.

*producer surplus.* The value a producer receives over and above his actual cost of production. Assume that each additional car costs more than the last because of capacity constraints that force overtime work and material constraints that lead to ever higher material prices. The cost per car might then range from, say, \$2,500 for the 100,000th car to \$3,500 for the 200,000th car. If 200,000 cars are sold and all are priced at the \$3,500 cost of producing the 200,000th car, the producer will enjoy a “surplus” over and above his marginal cost of producing each car except the last.

- profit.* The excess of revenues over costs. In financial analysis, all net returns to equity are considered profits. In economic analysis, the opportunity cost of capital is considered a basic cost of production and therefore is not included in profits, which consist only of "pure" profits above the opportunity cost of capital.
- protection.* Protection for domestic producers from international competition. May take the form of import duties (tariffs), bans, quotas or a variety of non-tariff barriers such as labelling requirements. More specifically, the actual difference between the domestic and border prices of a tradable good. Distinct from tariff, which is the "book" difference between the prices. Protection may be greater than tariff if quotas, for example, are imposed; may be less if nominal tariffs exceed those actually required (i.e. there is "water" in the tariffs).
- quota.* A limit on the amount, by quantity or value, of a product that may be imported (occasionally quotas may be set on exports, e.g. under commodity agreements).
- rate of return.* The profitability of a project. A shorthand term usually applied in economic analysis to the internal economic rate of return and in financial analysis to the annual return on net fixed assets or to the internal financial rate of return. (It is important to specify which.)
- real.* Real values reflect "real" physical quantities rather than prices thereof (see monetary, current prices, constant prices).
- redistribution.* See incremental income flow.
- rent.* The price paid for any factor of production in fixed supply.
- rental.* As in rental value of capital. The interest rate that must be paid as rent to use the capital for a given period (cf. asset (b)).
- replacement value.* The current cost of replacing a capital asset (cf. book value).
- risk, or probability, analysis.* A study of the odds of the project's earning a satisfactory rate of return and the most likely degree of variability (variance) from the best estimate of the rate of return. Important because, for example, project A may have at best guess a rate of return of 18 per cent, while project B has one of only 15 per cent. At the same time, however, there may be a 30 per cent chance that project A would earn less than 8 per cent, while there is only a 5 per cent chance that the return on project B would be so low.
- rupee.* Here defined as a general term for domestic currency. As opposed to a dollar, here defined as an international currency. Could just as well be peso or dinar.
- salvage value.* The residual value of the investment at the end of the project's life.
- scale.* The size of a project. See economies of scale.
- sensitivity analysis.* A study of the impact that changes in cost and benefits would have on the profitability or present value of a project. For example, a 10 per cent increase in construction costs might reduce the internal rate of return from 15 per cent to 9 per cent for project A, but only from 15 per cent to only 12 per cent for project B. Says nothing about the probability of deviations from the "best guess" (cf. risk analysis).
- shadow exchange rate.* The exchange rate that reflects the value of an additional unit of foreign exchange in terms of rupees of domestic consumption, given the trade policies that are expected to prevail during the life of the project. (Note: this definition is essentially that used in the original *Guidelines*. Others, including that used in this *Guide*, vary in detail, but the essential point is that foreign

exchange is often more economically valuable than is reflected by the official exchange rate because of restrictive trade practices such as quotas and duties.)

*shadow price.* A term implying a price that has been derived from a complex mathematical model, i.e. from **linear programming** (see **accounting price**).

*shadow wage rate.* The **opportunity cost** of labour, the value of production or leisure forgone elsewhere to employ labour in the project. (Note: unlike the Little-Mirrlees method, the UNIDO method does not burden the shadow wage rate with adjustments for the social premium on investment over consumption, income distribution etc. These are dealt with separately in clearly identified stages.)

*social net present value.* The **net present value** of a project after **incremental income flows** generated by the project have been weighted to reflect social income-distribution priorities.

*social premium on investment ( $P^{inv}$ ).* The additional value that savings and investment have over consumption because of the scarcity of investable capital. This premium on investment will exist whenever savings are not optimal, i.e. when the value of future consumption that would be generated by present investment discounted to the present is greater than the value of consumption today.

*social price.* Price that reflects the value to the country of **inputs and outputs** and takes into consideration "non-efficiency" but socially important goals such as a reduction of consumption of alcohol, tobacco and fancy cars or expanded production of goods to meet basic needs etc. (see **accounting price**, **economic price**, **market price**).

*sources-and-uses-of-funds statement.* See **cash-flow statement**; also called "sources-and-applications-of-funds statement".

*specific.* Given as a specific amount (e.g. a specific duty of Rs 100 per ton of wheat) (cf. *ad valorem*).

*standard conversion factor (SCF).* The ratio of the **world market (border) price** of an average basket of goods to its domestic market price, where the domestic price is expressed in **dollars** converted at the official exchange rate. It may also be considered the ratio of the official exchange rate to the **shadow exchange rate**. Further refinements are possible depending on what is contained in the basket of goods (e.g. there may be a conversion factor just for construction or just for transportation) (see **accounting price**, **accounting ratio**).

*supply.* Willingness to provide. Since willingness will vary depending on the supplier, the price and the circumstances, supply is usually expressed in terms of the quantities that would be supplied at various prices. The resulting "supply curve" usually slopes upwards, indicating that suppliers will supply more at higher prices than at lower prices. Where **economies of scale** exist, however, the supply price may drop as scale increases over the range where such economies prevail (cf. **demand**).

*surplus.* In short, something extra (see **consumer surplus**, **producer surplus**).

*switching value.* The value (e.g. the weight on income distribution to the poor) that reverses the ranking of two alternative projects. For example, alternative A will produce shoes with sophisticated modern equipment and very few workers, while alternative B will consist of a network of small workshops employing many poor artisans and very little capital equipment. Up to a weight of 1.5 on income going to the poor, alternative A has a higher rate of return. However, if income going to the poor is given a weight greater than 1.5, alternative B has the higher rate of return. Thus, 1.5 is the switching value. The same concept can be applied to discount rates (see **cross-over discount rate**).



*tariff* See **duty**.

*tradable*. A good that could be traded internationally in the absence of restrictive trade policies. Depending on national and world costs of production and transport, tradables may be importables, exportables, or in some cases both (e.g. the Union of Soviet Socialist Republics imports natural gas from Iran and exports natural gas to Europe).

*traded*. A good that is traded internationally. See also **tradable**; **traded, fully**; **non-traded**.

*traded, fully*. (a) *Export*: A good whose additional domestic production would all be exported; there would be no additional domestic consumption; (b) *Import*: A good whose additional domestic production would result in a decrease in imports with no additional domestic consumption (see **tradable**, **traded**).

*transfer payments*. Payments made without receiving anything directly in return (e.g. taxes, subsidies, contributions to charity). One-way transfers from donor to recipient.

*value*. As opposed to cost. A demand-side concept related to marginal consumer willingness to pay (e.g. "This wrench has a value on the market of \$8, but it would cost \$10 to produce domestically").

*value added*. The value of the final product minus the value of the material inputs purchased by the producer (material inputs include raw materials, intermediate inputs, fuel, supplies and utilities such as water and electricity, but exclude capital equipment). In other words, it is the value that has been added by the labour and capital employed by the producer. See **effective protection—Balassa and Corden measures**.

*variable costs*. Costs that vary with the volume of production (e.g. raw materials and, to a certain extent, labour and power). In the long run, of course, even fixed costs such as capital equipment become variable.

*weight*. A factor which, when multiplied by the value to be weighted, adjusts that value to reflect certain considerations. For example, if income going to the rich is considered less valuable than that going to the poor, and if income going to the middle classes is to be used as the standard of comparison (the *numéraire*), income going to the middle classes would be given a weight of 1.0, income to the poor a weight greater than 1.0, and income to the rich a weight less than 1.0.

*world market price*. The price at which the country could purchase from or sell to the rest of the world. Not to be confused with the price, for example, of tin on the London world tin market, for that price excludes transport costs to the country. For this reason, the term "**border price**" is often preferred to "world market price".

*world value added*. The **border price** of the **output** minus the **border price** of the material inputs (which may or may not include utilities and similar non-traded material or service inputs). See **effective protection—Balassa and Corden measures**.



## Bibliography

This bibliography reflects only a small fragment of the hundreds of articles and books that deal in some way with economic project evaluation. Those cited here were chosen for several reasons: some present complete systems of economic project evaluation; some present partial systems (e.g. Bruno); some present analytical tools important to economic project evaluation (e.g. Balassa, Baldwin and Hertz); and some present surveys or compendia of the literature (e.g. Lal, Harberger and Oxford University). Many more academic works were omitted to keep the bibliography accessible to the majority of readers of this *Guide*, but for those who wish to pursue the theoretical aspects in more detail, excellent bibliographies are appended to most of the works cited here.

Adler, Hans A. *Economic appraisal of transport projects: a manual with case studies*. Bloomington, Indiana University Press, 1971. 205 p.

A useful book for those wishing a more extensive discussion of the appraisal of transport projects than is given in the present *Guide*, which is more oriented towards industrial and agricultural projects. The section on fundamentals is followed by case studies on road, railway, port and aviation projects.

Agency for International Development. *Appraisal guidelines for development*. Washington, 1974.

A manual dealing with a wide variety of project-related issues in addition to economic appraisal. The first volume includes general discussions of topics such as the application of economic-financial criteria, the fundamentals of project preparation and appraisal, social criteria and sensitivity analysis. The second volume consists of more detailed guidelines for individual sectors such as agriculture and public health.

Balassa, B. and D. Schydlosky. Effective tariffs, domestic cost of foreign exchange, and the equilibrium exchange rate. *Journal of political economy*. 76:3: 348-360, May/June 1968.

An important article that focused widespread attention on the effective rate of protection and its potential use as a measure of the economic productivity of projects.

Baldwin, G. B. Discounted cash flow. *Finance and development*. 6:3:30-35, September 1969.

An elementary, lucid and useful discussion of discounted cash-flow analysis.

Benefit-cost analysis, 1971: an Aldine annual. By Arnold C. Harberger and others, eds. New York, Aldine Atherton, 1972.

A helpful anthology of articles on benefit-cost analysis taken from a variety of fields.

Bruno, M. Domestic resource costs and effective protection: clarification and synthesis. *Journal of political economy*. 80:1:16-33, January/February 1972.

Effectively brings to a close the recent debate on the relative merits of the Bruno ratio and the rate of effective protection as measures of a project's economic viability. Although these are both "partial" indicators in that they are based only on data for a single year and thus ignore the pattern of benefits and costs over time, they can be useful in the preliminary screening of project proposals.

Dasgupta, A. K. and D. W. Pearce. Cost-benefit analysis theory and practice. New York, Barnes and Noble, 1972. 270 p.

An introduction to some of the more academic questions relating to cost-benefit analysis, including utility theory, welfare economics and optimality. Also deals with the principles behind accounting prices and the bases for decision making in project selection. For a more elementary and condensed version, see Pearce's *Cost-benefit analysis*, London, Macmillan, 1974.

Dasgupta, P. A comparative analysis of the UNIDO Guidelines and the OECD Manual. *Bulletin of the Oxford Institute of Economics and Statistics*. 34:1:33-52, February 1972.

Analyses the real and apparent differences between the Little-Mirrlees and UNIDO methods as reflected in the original publications. (Note, however, that substantive conflicts have now been virtually eliminated with publication of the new Little-Mirrlees book (1974) and the present *Guide* )

Dasgupta, P. and J. E. Stiglitz. Benefit-cost analysis and trade policies. *Journal of political economy*. 82:1:1-33, January/February 1974.

Extends the theory of optimal taxation and government production to open economies. Examines rules for project evaluation and taxation. Concludes that world prices should be used for project evaluation unless quotas are present and that no tariff should be levied on intermediate products.

Gittinger, J. P. Economic analysis of agricultural projects. Baltimore, Johns Hopkins University Press, 1972. 221 p.

A basic, applied guide to agricultural project appraisal that should be useful to the practitioner and the student of project appraisal.

Harberger, A. C. "On the use of distributional weights on social cost-benefit analysis, *Journal of Political Economy*, 86:2: 87-120, April 1978, part 2.

Hertz, D. B. Risk analysis in capital investment. *Harvard business review*. 42:1:95-106, January/February 1964.

A readable yet reasonably complete treatment of basic concepts of risk, probability and sensitivity analysis in project evaluation.

Joshi, H. World prices as shadow prices: a critique. *Bulletin of the Oxford University Institute of Economics and Statistics*. 74:1:53-74, February 1972.

Points out the problems that may arise from the use of world prices as shadow prices. Helped to bridge the earlier gap between the Little-Mirrlees and UNIDO methods.

Lal, D. Methods of project analysis: a review. Washington, D.C., World Bank (World Bank Staff Occasional Papers, Number 16), 1974.

A rather technical review of basic issues raised by the various methods of economic project evaluation; at the same time, a helpful book that brings together loose ends concisely and thus creates a broader understanding of the issues of economic project evaluation. Useful bibliography.

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

A completely rewritten and much improved version of the seminal *Manual*, which was published in 1968 by OECD as volume II of *Social Cost-benefit Analysis*. Major areas of improvement are in the treatment of income distribution and government income.

Mishan, E. J. Cost-benefit analysis: (rev. ed.) New York, Praeger, 1976.

A broad-based though somewhat theoretically oriented introduction to cost-benefit analysis.

Overseas Development Administration. A guide to project appraisal in developing countries. London, H.M. Stationery Office, 1972. 126 p.

A down-to-earth manual for the application of the Little-Mirrlees method (based on the 1968 *Manual*). The bulk of the text is a series of check-lists on the technical, economic, managerial, and financial aspects of projects in specific sectors. The initial part, however, gives some simplified but useful guides to shadow pricing.

Oxford University. Symposium on the Little-Mirrlees manual. *Bulletin of the Oxford University Institute of Economics and Statistics*. 34:1, February 1972.

A valuable collection of eight articles covering both the theoretical issues that arise in economic project evaluation since publication of the original Little-Mirrlees *Manual* and the experience of users in applying the method.

——— Symposium on shadow exchange rates. *Oxford economic papers*. 26:2:147-206, July 1974.

A useful collection of papers by Balassa, Scott, Bertrand, and Batra/Guisinger on the methods and problems of calculating shadow exchange rates and the many factors that should be considered when doing so.

Presents the papers and records the discussion from a symposium that brought together academics and practitioners in a round-table analysis of the problems of economic project evaluation. Focuses on individual issues and debates in much more detail than is possible in this *Guide*.

Schwartz, H. and R. Berney, eds. Social and economic dimensions of project evaluation. Washington, D.C., Inter-American Development Bank, 1977.

Proceedings and papers of the Symposium on the Use of Socioeconomic Investment Criteria in Project Evaluation, Washington, D.C., 28-30 March 1973.

Sen, A. K. Control areas and accounting prices: an approach to project evaluation. *Economic journal*. 82:325:486-501, March 1972.

Discusses problems of shadow pricing in terms of the control that the project evaluator has over national economic policy.

Squire L. and H. G. van der Tak. Economic analysis of projects. Baltimore, Johns Hopkins University Press, 1976.

Sets forth a general approach to the economic analysis of projects that the authors have recommended for use by staff of the World Bank. The method, which is quite similar to that proposed by Little and Mirrlees, is currently being tested on selected projects around the world.

Van Horn, James C. Financial management and policy. 4. ed. Englewood Cliffs, Prentice Hall, 1977.

A helpful basic text on business finance. The chapters on capital budgeting are particularly useful in connection with the discussions in this *Guide*, as is the discussion of decision making under risk.



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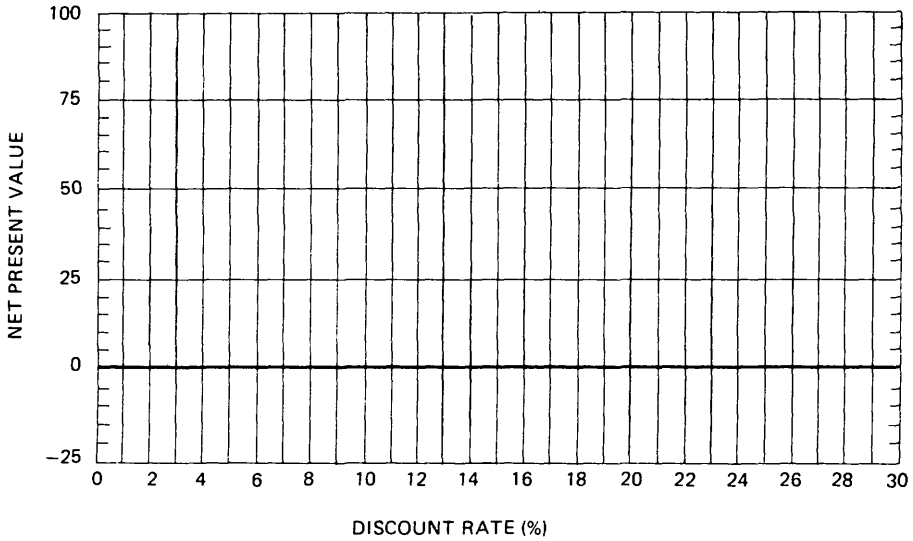
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### GRAPHICAL DISCOUNTING



*Values in year zero*

Year	<i>Discount factor</i>		<i>Present value of annuity</i>		Year	<i>Discount factor</i>		<i>Present value of annuity</i>	
	10%	20%	10%	20%		10%	20%		
1	0.909	0.833	0.909	0.833	16	0.218	0.054	7.824	4.730
2	0.826	0.694	1.736	1.528	17	0.198	0.045	8.022	4.775
3	0.751	0.579	2.487	2.106	18	0.180	0.038	8.201	4.812
4	0.683	0.482	3.170	2.589	19	0.164	0.031	8.365	4.843
5	0.621	0.402	3.791	2.991	20	0.149	0.026	8.514	4.870
6	0.564	0.335	4.355	3.326	21	0.135	0.022	8.649	4.891
7	0.513	0.279	4.868	3.605	22	0.123	0.018	8.772	4.909
8	0.467	0.233	5.335	3.837	23	0.112	0.015	8.883	4.925
9	0.424	0.194	5.759	4.031	24	0.102	0.013	8.985	4.937
10	0.386	0.162	6.145	4.192	25	0.092	0.010	9.077	4.948
11	0.350	0.135	6.495	4.327	26	0.084	0.009	9.161	4.956
12	0.319	0.112	6.814	4.439	27	0.076	0.007	9.237	4.964
13	0.290	0.093	7.103	4.533	28	0.069	0.006	9.307	4.970
14	0.263	0.078	7.367	4.611	29	0.063	0.005	9.370	4.975
15	0.239	0.065	7.606	4.675	30	0.057	0.004	9.427	4.979



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Printed in Austria

V.86-59981—October 1986—1,000

V.88-29581—October 1988—1,000

V.91-23700—May 1991—500

V.91-28737—September 1991—500

V.93-80457—February 1993—1,000

V.95-56070—July 1995—1,000

V.99-82920—April 1999—500

**ID/SER.H/3**