AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON, D. C. 20523

BIBLIOGRAPHIC INPUT SHEET

FOR AID USE ONLY

1. SUBJECT CLASSIFICATION

A. PRIMARY: Economics

B. SECONDARY: Agricultural Economics

2. TITLE AND SUBTITLE

Incorporating employment into agricultural project appraisal: a preliminary report.

3. AUTHOR(S)

Ward, William A.

4. DOCUMENT DATE: February 1975

5. NUMBER OF PAGES: 86p.

6. ARC NUMBER: ARC

7. REFERENCE ORGANIZATION NAME AND ADDRESS

Michigan State University
Dept. of Agricultural Economics
East Lansing, Michigan 48824

8. SUPPLEMENTARY NOTES (Sponsoring Organization, Publishers, Availability)

9. ABSTRACT

The central purpose of this paper is to point out the empirical questions which form the basis for much of the current discourse on project appraisal. In section II, the literature is reviewed and the basic issues are sifted out. In section III, the issues are posed in the form of research topics, the primary purpose being to offer guidance to field researchers indirecting their efforts towards providing answers to some of the basic questions underlying the disagreement among economists over project appraisal methods.

10. CONTROL NUMBER: PN-AAB-246

11. PRICE OF DOCUMENT:

12. DESCRIPTORS

Empirical questions, Project appraisal, Literature, Research topics, Methods

13. PROJECT NUMBER: 931-17-190-543

14. CONTRACT NUMBER: AID/CSD-3625

15. TYPE OF DOCUMENT: Working paper

AID 890-1 (4-74)

AFRICAN RURAL EMPLOYMENT RESEARCH NETWORK

WORKING PAPER

INCORPORATING EMPLOYMENT INTO
AGRICULTURAL PROJECT APPRAISAL:
A PRELIMINARY REPORT

by
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Working Paper No. 6 February, 1975

Department of Agricultural Economics
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INCORPORATING EMPLOYMENT INTO AGRICULTURAL PROJECT APPRAISAL: A PRELIMINARY REPORT*

by

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*This paper was prepared while the author was an Associate Professor of Economics at the University of North Carolina in Wilmington.

**This paper has been developed as part of a three-year study of rural employment problems in Africa which is being financed under an AID/Washington Contract (AID/csd 3625) with the Department of Agricultural Economics at Michigan State University.

February, 1975

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PREFACE

One of the objectives of the research undertaken under the African Rural Employment Research Network is to "further develop a conceptual framework for (a) analyzing employment problems and policies and (b) incorporating the employment objective into project, subsector and sector analysis in developing countries".

Dr. William A. Ward, the author of this Working Paper, divides his paper into three sections. First, he presents a critical review of the literature on alternative approaches to project appraisal. Second, he summarizes the major conceptual problems and difficulties in incorporating employment into agricultural project appraisal and third, he outlines a research program to improve our understanding of how to incorporate the employment objective into project appraisal through illustrations from ongoing research in Sierra Leone. The research in Sierra Leone is under the direction of Dr. Dunstan S. C. Spencer, Department of Agricultural Economics and Extension, Njala University College, University of Sierra Leone. (The research program in Sierra Leone is outlined in Working Paper No. 1, May, 1974.)

The field work in Sierra Leone will be completed in June of 1975 and the results will be analyzed and published during the 1975/76 academic year. Upon the completion of the overall research study, we will publish an African Rural Employment Paper on how to more effectively incorporate employment into agricultural project appraisal. Meanwhile, we invite criticism of this preliminary report from scholars and government officers.

Carl K. Eicher

I. INTRODUCTION: THE PROJECT APPROACH TO DEVELOPMENT

Numerous authors have criticized the "ad hoc" project approach to economic development which has characterized development activities of donors and developing countries. Reutlinger, et. al. [1971, p. 30] agrees that previous World Bank practices of financing, "...projects which surface to its attention and show an 'acceptable' rate of return..." should give way to funding projects which are part of some larger sectoral or national plan for the achievement of (single or multiple) national objectives.

There is some dissatisfaction with the project approach to economic development and some major donors have proposed "non-project" alternatives to development [US/AID, 1973]. Nevertheless, as Price Gittinger has pointed out, "Projects are the cutting edge of development" [1972, p. 1], at least for several more years. The nature of development projects is undergoing some change under the increasing overtness of national employment and other objectives--for example, the proliferation of rural development projects which a few years ago would have been rejected for funding by the World Bank and other donors (see, e.g., Gittinger (ed.) [1973]). Nevertheless, the concept (if not the fact) of "projects" will die slowly, if at all, for somehow national plans have to be divided up into manageable prices for purposes of implementation and management; and the prices (as well as the plans) must be subject to evaluation of their contributions to and consistency with overall national objectives.

Realizing the role that projects will continue to play for some time, the Michigan State University African Rural Employment Research Network (AID/csd 3625) has stated that an "...important objective of the proposed

research is to assist in developing a conceptual framework and research methodology for including employment objectives into project and sector analysis in developing countries" [Working Paper No. 1 of the African Rural Employment Research Network, 1974].

The objective of including employment considerations in project appraisal is not without controversy, as those familiar with the project appraisal literature will attest. Some development economists argue convincingly that employment is not an objective or a goal but is rather a <u>means</u> to meeting higher objectives such as optimal consumption over time and that employment objectives are met as a by-product of attempts to achieve the aggregate consumption objective [OECD, 1968]. Others (e.g., Keesing [1972]) argue that employment generation does not emerge naturally from the process of pursuing traditional macroeconomic objectives but instead must be pursued separately as an additional objective.

Since 1955, the project appraisal literature has increasingly reflected these (and other) differences of opinion among experts. The discourse has finally centered on some very difficult conceptual and philosophical issues,[1/] pushing aside for the moment several empirical questions that newer project appraisal models have answered by assumption.

[1/] See Harberger's [1972] plea for acceptance of "three basic postulates for applied welfare economics" as a basic starting point for project appraisal methods. These are: (a) the competitive demand price for a given unit measures the value of that unit to the demander; (b) the competitive supply price for a given unit measures the value of that unit to the supplier and (c) when evaluating the net benefits or costs of a given action (project, program or policy), the costs and benefits accruing to each member of the relevant group (e.g., a nation) should normally be added without regard to the individual(s) to whom they accrue. This will be recognized immediately as the "potential Pareto" criterion or the Kaldor-Hicks compensation principle, based in individualistic welfare theory. He further calls for a rejection of income distribution considerations in project appraisal.

The new "social benefit cost" and "multi-objective benefit cost" models have generated a whole new body of economic literature. The complexity of the pricing rules used therein have clouded three important underpinnings of the models:

(1) the movement away from strict individualistic welfare theory implied in the potential Pareto criterion,

(2) several important behavioral assumptions which are subject to empirical testing, and

(3) the explicit consideration of "indirect" effects.

The question of the welfare theoretic underpinnings is rightly one to continue to address in the theoretical literature. But it is also a question which must be approached from more than one perspective. The individualistic ethic of classical liberalism, as suggested by Harberger, is perhaps one starting point; but the rejection of the individualistic ethic in varying degrees in favor of a group ethic is implicit in many of the societies in which benefit-cost analysis has been applied in recent decades. The confusion apparent in the literature derives in part from the attempt to devise a technique applicable to all times and all places. The possibility that societal ethics differ should be considered in attempts to devise project appraisal rules. This too is partly an empirical question which in the end depends upon personality theory's settlement on an interpretation of human behavior. In addition, an implicit value judgment is made by project appraisal theoreticians that the existing distribution of income should always serve as a starting point for the analysis of projects, even when the analysis involves income distribution objectives. The particular distribution of income and wealth, of course, clearly affects factor and product prices and thus "shadow" prices as well. Some debate of this issue

is taking place in the theoretical literature (see, for example, the exchange between Samuels and Buchanan [1973]). These questions, while extremely relevant at a very basic level to all of economic analysis, are, however, not the subject of the present paper.

With respect to the second issue, the literature has seldom addressed the empirical question of savings-investment behavior of different groups of income earners--a question of tantamount importance in determining whether social benefit-cost analysis has anything to offer over traditional approaches. It might well be that "good" project appraisal need not resort to the complex pricing systems involved in social and multiobjective analysis. Other important questions are also glossed over in the literature on the newer methods of appraisal. It is quite possible that a whole superstructure has been built up to correct for problems which simply do not exist or are not really very important. However, these are empirical questions which can only be answered by detailed and costly field research. They are questions which badly need to be answered though.

The third issue of indirect effects has, somewhat surprisingly, generated far less controversy than did "indirect benefits" in the literature of the 1950's and 1960's regarding the use of indirect benefit concepts in traditional "efficiency" benefit-cost analysis. Perhaps the relationships between the indirect benefit concepts and the appraisal procedures involved in social benefit-cost analysis have not been fully realized.

The central purpose of this paper is to point out the empirical questions which form the basis for much of the current discourse on project appraisal. In section II, the literature is reviewed and the basic issues are sifted out. In section III, the issues are posed in the form of research topics, the primary purpose being to offer guidance to field research-

ers in directing their efforts towards providing answers to some of the basic questions underlying the disagreement among economists over project appraisal methods.

II. CONCEPTUAL ISSUES IN PROJECT APPRAISAL

Approaches to Project Appraisal

Benefit-cost analysis traditionally has been the method by which the contributions of projects to the nation's objectives have been evaluated. The technique provided the filter through which projects which made the greatest contributions to the nation's development goals were separated from those making lesser contributions. So long as the national goals were uni-dimensional--that is, capable of being included under or translated into the national income goal--there was no problem. However, as evidence began to mount that such national goals as equity (subsumed under the employment and income distribution objectives), efficiency (i.e., the national income objective) and growth (i.e., capital accumulation) might well be competitive rather than complementary [Hag, 1972; Keesing, 1972; Galenson and Leibenstein, 1955] approaches to project appraisal which would allow the inclusion of competing objectives began to be sought.

Out of the discourse regarding operational approaches to translating societal goals into project choice criteria has emerged three distinct approaches to project appraisal. These approaches are referred to herein as (1) the "efficiency" approach or efficiency benefit-cost analysis, (2) social benefit-cost analysis and (3) multi-objective benefit-cost analysis. Though the three approaches have historical beginnings in the chronological order of the above, one finds the simultaneous existence of all three approaches in practice and in the literature.

Efficiency Benefit-Cost Analysis

The first approach to emerge was the efficiency approach, in which only one objective was considered: national economic "efficiency" or national income.[2/] Initially, market prices were used in evaluating project benefits and costs. Later [Kahn, 1951; Chenery, 1953; Tinbergen, 1955] "shadow" prices began to be recommended. These shadow prices were at first deemed to be those prices which would prevail under "optimal" government policies which did not distort the structure of market prices. The relevant prices were to be derived from a programming model of the economy in equilibrium [Blitzer and Taylor, 1973; Balassa, 1971].

Some disagreement is found in the literature regarding (1) whether market or shadow prices should be used in project appraisal at all [Weckstein, 1972; Mishan, 1971; Balassa, 1971] and (2) if one accepts the shadow price argument, how the shadow prices are to be estimated.

Efficiency benefit-cost analysis, as defined herein, possesses the following characteristics:

(1) it is directed largely towards maximum national "efficiency" and

(2) it uses either

(a) market prices or

(b) shadow prices derived from programming models.

[2/] "We have referred to economic efficiency as a concept for expressing the size of the economic pie that is superior to the concept of national income. The difficulty with national income is that it is too closely tied to market values" [Marglin, 1963-a, p. 20]. The use of efficiency as the only objective stemmed from the Neo-classical model's suggestion that the traditional economic objectives of efficiency, employment, growth and foreign exchange balance would be achieved simultaneously.

This approach is characterized by United States Senate Document 97 [1962], UNECLA [1958], UNECAFE [1961] and current World Bank practices.

Social Benefit-Cost Analysis

The use of shadow prices in project appraisal led to a continuing discourse over the social content of prices. Galenson and Leibenstein [1955] pointed out that the use of shadow prices for labor in project appraisal would lead to increased labor intensity. However, since most developing countries ostensibly experienced low rates of saving, capital formation and growth, increased labor intensity would increase the proportion of current national income consumed and affect the growth rate. This would occur because the propensity to consume among wage earners assumedly is higher than that among recipients of profit and interest income.

The efficiency growth tradeoff and the pricing system entailed is the essence of social benefit-cost analysis. Marglin [1963-b, 1963-c]; Sen [1961, 1967]; Tinbergen [1956]; Pigou [1951] and others have argued that market-determined rates of interest and saving are socially nonoptimal and that the process of shadow pricing should also include the social value of saving versus that of consumption. This has been operationalized in Eckstein [1957]; OECD [1968]; Marglin [1967]; UN/IDO [1972] and Lefeber [1968].

Social benefit-cost analysis as defined herein possesses the following characteristics:

(1) It deals with two competing objectives:

(a) efficiency

(b) growth.

(2) It uses shadow prices which reflect:

(a) the relative scarcity of resources

(b) the relative "social" value of consumption versus saving.

(3) A single "numeraire" objective function is maintained by using two interest rates for converting alternative future income streams into present values:

(a) an opportunity cost of capital based on the rate of return in alternative uses

(b) a discount rate for future consumption based upon "social" time preference.

Multi-objective Benefit-Cost Analysis

The current trend towards acceptance of multi-objective benefit-cost analysis realized a growth spurt in 1967 with the publication of Marglin's book, Public Investment Criteria. However, earlier work had been done by the river basin modeling group at Harvard University [Maass, et. al., 1962] (of which Marglin was a participant) and the Philippine Government (Hsieh, 1968]. The most important current application is the United States Water Resources Council's suggested guidelines for water project appraisal, approved in revised form by Congress in October of 1973 [United States Water Resources Council, 1969].

The essence of multi-objective appraisal is the overt consideration of project objectives other than the efficiency and growth objectives. These may include objectives previously considered to be "noneconomic" in

nature, such as environmental quality [United States Water Resources Council, 1969].

The presence of multiple objectives[3/] creates difficulties for the usual approach to economic analysis, since there is no single objective function to be maximized. Rather, there are several objectives to be optimized. The difficulty is that optimization requires that the objectives be converted into a single measure, i.e., that a common denominator exist to convert the outputs into the "numeraire" which is to be maximized. If noneconomic or even competitive economic objectives are included, the conversion factors represent "marginal utility" measures from a social welfare function. The difficulty in specifying this function has led to alternative approaches to implementing multi-objective benefit-cost analysis. Thus, within the technique called multi-objective benefit-cost analysis, there are three identifiable approaches:[4/]

[3/] One must be careful to distinguish between project objectives and project purposes. Objectives represent the goals or particular ends sought, i.e., they have social welfare content. Examples are consumption levels or social stability, in addition to the more common goals of income and economic stability. Purposes, on the other hand, are really the means by which these objectives are achieved--water supply, flood control, irrigation, etc. The distinction between purposes (means) and objectives (ends) is sometimes difficult to maintain, however. This is mostly clearly the case with employment. Certain authors (e.g., UNIDO, 1972; OECD, 1968] view employment as a <u>means</u> for achieving the aggregate consumption objective. In some cases, it is sought as an objective in its own right, though largely as a proxy for other more difficult to measure objectives. Such objectives sought for their own sake are usually classified by economists as "merit wants" and then down-played as considerations for "social" projects rather than "economic development" projects [see UNIDO Guidelines, 1972, p. 33].

[4/] Constable [1971] identifies a similar set of approaches.

(1) the "decision matrix" or "impact matrix" approach in which the major objectives are set up as categories and project effects upon each category are listed separately [Hill, 1968; United States Water Resources Council, 1969; McKean, 1958];

(2) the "constraint" approach in which contributions to one principal objective are maximized, subject to specified minimum contributions to other objectives [Vellin, et. al., 1972; Blitzer and Taylor, 1973; Marglin (Maass, et. al., 1962)];

(3) the "multi-objective function" approach in which objectives are set up, weights are attached to each objective according to its importance and conversion factors are specified for converting noncommensurable impacts into a single "objective function" which can be optimized [OECD, 1968; UNIDO, 1972; Eckstein, 1961].

The "decision matrix" approach is the easiest of the three to implement on a project-by-project basis. It has the added attraction that, over time, weights can be derived from the choices made by decision-makers between different projects' contributions to different objectives. It is more appropriate in circumstances where there is a commitment to more than one objective, but where the relative importance (weight) of each commitment is not known.

The efficient preparation of projects under the "multiple objectives function" approach requires that the project designer know before hand the relative weights applying to different objectives. The "decision matrix" approach, on the other hand, allows the analyst to proceed with the multi-objective analysis without a pre-specified "social welfare functions". However, he lacks the needed guidance in preparing projects specifically

directed towards the exact magnitudes of importance of the plan's stated objectives.

The Water Resources Council Guidelines [1969] requires that a different project alternative be prepared for each objective account. Each alternative is directed towards maximizing the projects' contributions to the respective objective. If there are four different objectives, then four alternatives must be prepared. The decision-maker is thus given an opportunity to make (and demonstrate) a choice between the different tradeoffs. Project agencies, after observing the general flavor of the choices made, begin to know what mix of projects gets funded and can direct more attention to preparing "optimum" projects as an additional alternative.

The difficulty with the WRC approach, besides its cost, is the problem of deriving the multi-objective function from the choices made by the project selectors. This is particularly the case where different objectives apply to different regions of a country. A relatively large number of project choices would have to be made before project agencies could begin to make reliable estimates of the project choice function.

A far more efficient alternative would involve the kind of communication system between the planning office and project agencies that is suggested in practically every treatise on development planning. While the planning office might not be able to give an explicit set of weights initially, if constant line communication were maintained, after a few project choices and tradeoffs were made, the planning office could begin to issue memoranda relating to the emphasis to be given to different objectives in project design. Thus, the decision matrix approach should eventually give way to the multi-objective framework, if projects are to be designed in

conformity with multiple national objectives.[5/] This is the approach advocated in the UNIDO Guidelines [1972].

The "constraint" approach, on the other hand, represents something of an intermediate step between the "decision matrix" and the "multi-objective function". The "constraint" approach specifies a minimum acceptable contribution to the objectives which are not "principal". The principal objective is maximized subject to the constraints imposed on the other objectives.

Marglin [Maass, et. al., 1962] identifies three different "constraint" approaches to multi-objective analysis. He discusses these in terms of tradeoff decisions involving the "efficiency" objective and the redistribution objective:

(1) "Method I" - Minimize the efficiency costs of providing a specified level of redistribution.

(2) "Method II" - Combine both efficiency and redistribution in the objective function by assigning relative value weights to each. Maximize the weighted sum subject to the production constraints.

(3) "Method III" - Maximize redistribution subject to an efficiency constraint.

The ranking function which emerges is the value of objective function. No alternatives which fail to meet the constraints are considered for

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[5/] The proposal to use the "decision matrix" approach in the United States water program really represents a recognition of two factors which apply in the United States case: (1) the ability to "afford" several design alternatives for each project and (2) the belief that Congress does not wish to make its choices explicit, since this would reveal the fact that some people "lose" in the process of project selection [see Schmid, 1970].

adoption. Marglin's "Method II" is basically the "multi-objective function" approach discussed below.

Vellin, et. al. [1972] used the "constraint" approach in an agricultural sector analysis of Mauritius (Blitzer and Taylor [1973] give a useful review of linear programming type planning models). They sought to maximize the agricultural balance of payments subject to land, manpower and domestic consumption constraints. A similar approach might be used in project appraisal, where certain constraints were placed upon each objective account except one. The remaining account would be maximized subject to the constraints placed upon the other account.[6/]

The "constraint" approach would yield a set of implicit weights for the different objectives as a by-product of the analysis. These weights are in the form of "opportunity costs" in terms of the principal objective of setting the constraints at that particular level. By iteratively changing the constraints, a "transformation function" between objectives could be traced out for each project. The presence of a "social welfare function" (or of a set of weights for the objectives) would allow for a "tangency" solution yielding the optimum project design. However, it is the absence of that function which leads to the use of the "constraint" approach.

The "constraint" approach is useful where the explicit weights for objectives are not known but where it is known that certain minimum contributions to particular objectives are important. The particular projects selected will implicitly determine the weights placed on each objective. Thus, under project scarcity (as opposed to budget constraints), the pro-

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[6/] This is basically the approach that is forced upon public investment projects in the United States, where environmental controls under the National Environmental Protection Act (1969) serve as constraints.

ject agencies will implicitly determine the objective's weights, even though the constraints are passed down to them from above.

Finally, the "multi-objective function" approach is tantamount to a social welfare function. The project analyst is given a set of weights for each objective and factors for converting contributions towards each objective to a common denominator. His task is to design the project alternative which maximizes the resulting objective function.

Keeney [1973] has discussed this approach in analyzing the optimum location of a new airport for Mexico City. A "multi-attribute utility function" is generated for ranking the alternatives. The attributes include total cost, capacity in terms of number of aircraft operations per hour, access time to and from the airport weighted by the number of travelers from each zone, number of people injured or killed per aircraft accident, number of people displaced by airport development and number of people subjected to a high noise level.

McGaughy and Thorbecke [1972] have used a similar format for analyzing the choice of irrigation projects in Colombia. The authors undertook a sensitivity test of project rankings under different weighting schemes for the different objectives. The weights ranged from one of equality between objectives to one of treating each objective as twice as important as the others. The objectives of the national plan were:

(1) increased per capita income,
(2) reduced dependence upon international markets--i.e., balance of payments equilibrium,
(3) reduced underemployment and unemployment, and
(4) a more equitable distribution of income,
[McGaughy and Thorbecke, 1972, p. 37].

These objectives were collapsed into a series of measures designed to measure the contribution of the projects to each of the plan objectives.

Contributions to the income objective were measured through two criteria: the benefit/cost ratio and the "social marginal product" (which included indirect effects on the balance of payments). The balance of payments objective was treated through the foreign exchange/investment ratio (i.e., F/K). The income distribution objective was not explicitly included but was assumed to be indirectly treated under the employment objective, contributions to which were measured by the employment/investment ratio.

While much of the theoretical discussion of weighting has followed the Marglin [1967] and Little-Mirrlees [1969] work, the Republic of the Philippines has been using a weighting system for project appraisal since the 1957-1961 plan [Hsieh, 1968]. A set of criteria for selecting among projects with employment as a major consideration was laid out in 1962 (Republic of the Philippines [Hsieh, 1968]).

Hsieh [1968] reports that the government of Turkey also used a system of project priorities resembling a weighting system during the 1963-1967 plan period. While the plan made explicit provision for employment, it did not make clear the weights to be applied to employment relative to other objectives.

Some form of the multi-objective function approach is preferred to other approaches, since it gives greater guidance to project planning at all stages of project development. However, as has been pointed out, the multi-objective function approach requires a statement of (1) the objectives to be pursued, (2) the relative importance of each objective and (3) conversion factors for converting nonadditive benefits into a common denominator. These requirements are tantamount to a specification of a "social welfare function".

Shadow Pricing

Basically, there are three key prices that affect the choices made in designing and selecting projects: the price of labor, price of capital and the price of foreign exchange. The shadow price of each of these items will be discussed below.

Shadow Pricing Foreign Exchange

If foreign exchange at the official rate is underpriced relative to prevailing scarcities, then the cost of imported factors and goods will also be understated; decision-making based upon market prices for labor and capital will reflect an uneconomical bias towards capital intensity.[7/] The argument that imported goods should be valued at the opportunity cost in terms of domestic goods is long-standing and well-known [Chenery, 1953]. A more recent argument has been made that domestic goods be converted to foreign exchange [OECD, 1968]. In theory, the two procedures yield reciprocal conversion factors and identical decisions [Balassa, 1971]. In practice, the method used in determining the conversion factor has potentially significant effects upon the relative factor shadow prices which emerge.

Bacha and Taylor [1972, p. 30] report that, "Unfortunately, economic theorists are not unanimous in their recommendations to the practical foreign exchange shadow pricer". There are two basic sets of disagreements among economists. The first is between those who favor the use of an

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[7/] A thorough discussion of factor market distortions is found in Magee [1973].

"equilibrium" rate and those who argue that the rate should conform to the expected government policies. The second discourse is among those who agree that some "equilibrium" rate is appropriate but disagree as to how to estimate the equilibrium rate.

Weckstein [1972] argues that the (shadow) prices for public sector decision-making should be the same as those faced by the private sector. The argument is simply that the sector faced by a higher price for an input will use relatively less of that input than the sector facing a lower price. The equi-marginal principle indicates that higher net returns would be realized if some of the input were reallocated from the lower-price to the higher-price use where its marginal value product is ostensibly greater. If the prevailing market price structure is to continue throughout the life of the project, then market prices should be used in appraising the project to assure that the project meets the "second best" optimum under the expected conditions. Thus, it is argued, unless the government is expected to change the policies which distort the foreign exchange market, shadow prices should not be used in project appraisal. Balassa [1971], on the other hand, points out that the use of market prices in project appraisal will create vested interests which will increase the resistance to changing towards more optimal policies.

The problem with pricing schemes which anticipate policy changes over some finite time horizon leading towards optimal policies is that project decisions in the meantime necessarily involve non-second best input mixes, unless the time profile of policy changes can be integrated into a set of chronological shadow prices for use in pricing project costs and benefits in each time phase of the project's life. For example, if optimal trade policy changes were to take place at intervals over a twenty-year period,

a different shadow exchange rate would be required for project pricing at each stage [Chakravarty, 1964]. Thus, the analyst must estimate the series of relevant equilibrium rates.

The differences among those accepting the equilibrium rate basically boils down to the estimation problem. Most accept the "ideal" price to be that which would prevail in the absence of trade restrictions and under free-floating exchange rates. The problem is to estimate what that rate would be.

There is widespread agreement that the appropriate means for estimating the shadow exchange rate would involve a programming model [Blitzer and Taylor, 1973; Balassa, 1971; Bacha and Taylor, 1972; Chenery, 1953; Chakravarty, 1964]. Balassa [1971] has pointed out the information requirements for the task:

(1) the value of imports and exports,

(2) the nominal rates of protection on traded goods,

(3) the domestic elasticities of import demand and export supply, and

(4) the foreign elasticities of export demand and import supply.

Bacha and Taylor [1972] argue that the relevant information includes not only that for traded goods but also for the nontraded goods which <u>would</u> be traded, if optimal trade policies were pursued.

Obviously, the programming solution is a monumental task. The basic difficulties have been variously pointed out by Weckstein [1972], Balassa [1971] and Bacha and Taylor [1972]:

(1) data limitations in developing countries,

(2) arbitrary time horizons over which the objective function is optimized,

(3) simplicity of the objective function,

(4) the necessity of aggregating factors and products,

(5) the shortcomings of the linearity assumption and

(6) the tendency for the coefficients to reflect either

(a) current input-output relationships or

(b) experiment station type relationships.

These difficulties have led to "short cut" attempts to shadow price foreign exchange. Bacha and Taylor [1972] divide the approaches into groups involving three different assumptions:

(1) The foreign exchange shadow price should reflect the value in terms of welfare to the economy of an additional dollar of foreign exchange.

(2) The foreign exchange shadow price should reflect the opportunity cost of a dollar in other uses.

(3) The foreign exchange shadow price should be the "equilibrium" exchange rate with varying assumptions about what the equilibrium rate may be.

The first two approaches, in principle, do not differ since the opportunity cost should reflect the marginal value (welfare) in alternative uses. Harberger's [1965, 1972] approach appears to come under such a heading. He supports the concept that the relevant exchange rate should be derived from the likely pattern of imports from an incremental dollar of foreign exchange. According to Bacha and Taylor [1972, pp. 37-38], Harberger's [1965] shadow exchange formula makes the rate equal to "... the weighted sum of domestic prices of traded goods, divided by a similar weighted sum of world prices, the weights in each case being the marginal changes in imports and exports induced by the project".

The Little-Mirrlees approach stands the shadow exchange problem on its head. Their approach converts all domestic prices to border prices and makes foreign exchange the numeraire. The Little-Mirrlees pricing system would value all traded goods at border prices; nontraded goods would be valued at world prices by dividing the inputs involved directly and indirectly in their production into traded goods and labor components. The traded goods component is then valued at border prices. The labor component is converted to world prices by assuming that all labor income is consumed and converting the consumption basket to world prices.

To operationalize the world price concept, Little and Mirrlees develop a "standard conversion factor" (SCF) to convert nontraded goods to world prices. The SCF is derived by revaluing a broad range of domestic goods in world market prices and estimating the difference between the world and domestic prices of the group. Balassa [1971, p. 14] points out that the resulting conversion ratio is "...the average rate of nominal protection (for short, tariffs) on wage goods".

The Harberger, Little-Mirrlees and Bacha-Taylor approaches represent three different methods of deriving shadow prices. The basic practical differences involve the commodities included in the shadow pricing bundle:

(1) Harberger uses the "likely pattern" of incremental purchases.

(2) Little-Mirrlees use a two-stage procedure:

  (a) valuing tradeables at border prices and

  (b) converting nontradeable using the SCF.

(3) Bacha-Taylor prescribe a formulation which includes not only current but also potential traded goods.

Unfortunately, the "best" approach will differ from country to country depending upon the relative weights placed upon the different objectives and the relative distortions within and between the tradeable and nontradeable goods sectors.[8/] The most workable approach for most developing countries is probably the Harberger [1965] approach. He suggests the practical procedure of using past trade statistics to estimate the likely pattern of incremental imports. In the absence of data on "effective" protection, the nominal rates on the affected goods are used in estimating the shadow rate of exchange.[9/]

Most practical approaches to shadow pricing really represent an "indexing" problem, in which the relative distortions (based on either nominal or effective protection) are weighted by the currency volume of the good in trade. The equilibrium approach makes the weight the volume which would prevail under optimal trade policies. In practice, the prevailing trade flows are normally used. For incremental or "piecemeal" decision-making, the current mix is perhaps appropriate, since it probably more closely represents the likely pattern of incremental trade. If projects are to represent part of the push for optimal policies (or if such policies are anticipated), the equilibrium mix is more appropriate for deriving the price to apply for the later years of project life.

[8/] "In many developing countries, the price distortions between tradeable and nontradeable goods caused by tariffs and other trade restrictions appear to be worse than distortions within the nontradeable goods caused by surplus labor... For these countries, at least, we recommend the use of shadow exchange rates (i.e., the 'equilibrium type') in project evaluation rather than the Little-Mirrlees method," [Bacha and Taylor, 1972, p. 46].

[9/] The nominal rates may be used in the input-output framework discussed in the section on indirect benefits. Similar approaches to estimating effective protection are discussed by Corden [1966] and Humphrey [1969].

The appropriate shadow pricing procedure would involve estimating the shadow price from incremental imports under current policy for the immediate years and deriving a time sequence of shadow prices for future years based upon expected government policies in those years. This approach assumes that government trade policies are independent of project decision-making, i.e., that the shadow rates selected do not alter the course of future rates. If this assumption is not met, then the series of shadow rates will be endogenously determined, greatly complicating the estimation process.

Shadow Pricing Capital

The role played by the interest or discount rate in terms of the employment and income distribution effects of projects is much greater than one might initially expect. This is true, for example, because two of the three roles of the interest rate implicitly involve the choice of capital- versus labor-intensity. These three roles are:

(1) to allocate consumption optimally between current and future periods,

(2) to (help) determine the optimum mix of capital and labor in projects and

(3) to allocate capital between private and public uses.

In tasks (1) and (2) above, capital intensity and thus income distribution will be affected in two ways. First, the lower the discount rate, the greater will be the present value of a project involving a large initial outlay and a benefit stream occurring in the future. When compared

to an alternative producing the same benefit stream but having a smaller capital outlay and larger future costs, the capital-intensive alternative will look relatively better the lower the discount ratio used in comparing the two. Thus, a lower discount rate will tend to favor projects with "front-loaded" costs (i.e., capital-intensive projects) as opposed to projects with lower initial costs and higher future costs. This capital bias holds for both public and private investments.[10/]

Second, the income from capital intensive projects accrues as income to (higher income) individuals who assumedly have a higher MPS. Galenson and Leibenstein [1955], Eckstein [1957] and OECD [1968] assume that a larger reinvestible surplus is generated by capital-intensive projects. Since reinvestment of project benefits increases income and consumption in future years rather than immediate years, a lower discount rate makes projects possessing reinvestment attributes look relatively better. Since it is assumed that profits and interest get reinvested while wages get consumed, capital-intensive projects receive an additional edge when future consumption is discounted at a lower rate. Thus, an additional capital bias is involved in public projects where reinvestment is considered.

The interest rate plays the three roles outlined above by determining the "price" of investment capital. Neo-classical theory stresses that the price should represent the alternative returns foregone by not using these resources elsewhere. In a freely functioning capital market with no externalities, this cost would be represented by the interest charges incurred in securing the capital. The interest charge also would represent

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[10/] Wells [1972, p. 6] indicates that, "Those firms that have received money at 12 percent annual interest under the (subsidized interest) program seem generally to have chosen a more sophisticated technology than their domestic competitors who are forced to pay 24 to 36 percent."

the rate at which future consumption was discounted relative to current consumption by the individuals participating in the capital market. Neo-classical theory holds that the interest rate which emerges will represent the equilibration of individual saving and investment schedules, thus simultaneously supplying the social time preference (STP) rate at which savers (households) discount the future and the opportunity cost of capital (OCC) rate indicating the incremental rate of return of investment. Discounting additional projects at this simultaneous rate will both insure inter-temporal welfare maximization (i.e., "optimal growth") and temporal efficiency of resource use.

There are several difficulties which prevent one from simply using "the" market rate of interest for "pricing" public investments. First, more than one market rate exists. The reasons are several:

(1) Different investments and different individuals involve different levels of risk and uncertainty; an interest premium raises some borrowing rates above other rates [Feldstein, 1964].

(2) Tax policies cause net returns to differ between investors. Thus, rates of return on capital vary from one sector to another [Baumol, 1971].

(3) Changing monetary policies and capital rationing lead to differences in yields on long-term instruments.

(4) Government policies to provide subsidized credit to certain groups lead to differences in borrowing rates.

(5) The "transactions costs" involved cause the rates paid to savers and rates charged to lenders to differ. In developing countries, capital rationing and monopolistic money markets often lead to

differences of several percentage points [UNIDO, 1972].

(6) Monopoly elements cause marginal returns to differ [Baumol, 1971].

Each of these reasons leads to a difference between the STP and OCC rates. Thus, no single rate exists which will simultaneously satisfy inter-temporal choices and static efficiency.

Second, the existence of externalities in saving-consumption choices may lead to "social" rates of time preference differing from the constellation of private choices embodied in perfectly functioning capital markets [Graaf, 1957; Feldstein, 1964; Dobb, 1960]. Marglin [1963-b] argues that there is a "collective consumption" element to the choice of present versus future consumption, since the saving decisions of others will affect the overall growth of the economy and thus the future consumption choices available to the individual. If one could be assured that others would save more, he might choose to increase his rate of saving above that which would prevail if the individual felt he were operating alone. Thus, the "collective choice" rate will be lower than the "private choice" rate.

Third, Pigou [1951] and others [Sen, 1961; Jolzman, 1958] have argued that the government's rate of time preference should be lower than that of its constituents, since government is assigned the task of protecting the consumption rights of those yet unborn. Marglin [1963-b] rejects this "authoritarian" approach to determining the STP rate.

Fourth, current theories of interest emphasize the loanable funds and liquidity preference approaches rather than the Neo-classical approach which treated interest as the equilibrator of real saving and investment [Shackle, 1961; Feldstein, 1964].

Fifth,

> Even if it is granted that saving versus consumption decisions are properly social decisions, there remains the problem of aggregating the time preference maps of individuals for collective decisions into a single social time preference map. This problem is a special case of the general problem of aggregating individual utility functions into a social welfare function, [Marglin, 1963-b, p. 109].

Sixth, having achieved a "social time preference map," the rate which will prevail will be a function of the level (and distribution) of consumption available per year. The particular rate will vary with the level and growth rate of consumption, the latter being a function of investment, which is in turn a function of the STP rate. This has two obvious ramifications upon the discounting process. First, except in special cases, a different discount rate will be used for discounting the benefits and costs of each year of the project's life. Secondly, the discount rate for a particular year will depend on the level of consumption in that year, which is a function of prior investment (the public project included); thus, an optimum growth model is required to determine the time stream of STP rates. A conceptual problem emerges in the estimation of an "optimum growth model" which complicates matters greatly; that is, the possibility that the growth process itself will affect not only the STP rate but also the function [see Feldstein, 1964; Marglin, 1963-b].

These difficulties have led to the emergence over time of several recommendations for handling the discounting and investment pricing problem. While there have been several variants proposed, basically three approaches are recognizable:

(1) the social time preference (STP) approach,

(2) the opportunity cost of capital (OCC) approach and

(3) a combined STP-OCC approach, the social opportunity cost (SOC) approach.

The STP approach advocates the use of a "social rate of discount" which reflects the intertemporal choices of society as a whole. Most theorists who advocate this approach do so in the belief that the STP rate is lower than the market rate. Thus, in terms of intertemporal social choice, the present is weighted too heavily and investment is sub-optimal. The government's role is to increase the level of investment either by direct public investment or indirectly by undertaking policies to stimulate private sector investment [Marglin, 1963-c].

Several variants of the STP rate have been proposed. Marglin [1963-b] discusses three of these. The "authoritarian answer" applies to the determination of a rate by governmental authorities in order to prevent the present generation's desires from running roughshod over future generations. This approach was initiated by Pigou [1951] and has been variously advocated by Dobb [1960], Holzman [1958] and Sen [1961]. Others (Tinbergen [1956], Eckstein [1958], Bain [1960] and Marglin [1963-b]) have argued that only the views of the present generation should be considered.

A second approach discussed by Marglin is the "schizophrenic answer" in which he argues that "economic man" and "the citizen" are two different individuals with two different time preference functions. The same individual reacts differently in his different roles. In actuality, it is difficult to see the difference between the "schizophrenic answer" and the "interdependence answer", Marglin's third approach in which he argues that individuals would save more if assured that others would also save more.

Much of the discussion of the STP rate has revolved around the "pure time discount", which relates to the discounting of future returns solely on the basis of futurity, i.e., not considering any risk (including personal demise). These have typically assumed that the pure time discount is the same through time and for all rates of consumption and growth. Feldstein [1964] atrributes this approach to Tinbergen and Eckstein.

A sophisticated version of the social time preference (STP) approach involves the functional relationships between the STP rate, the level of consumption and the growth rate of aggregate and/or per capita consumption. This approach uses the traditional indifference curve analysis in which current income is arrayed on one axis, while income "next year" is arrayed on the other axis. The analysis is Fisherian, with an imputed convexity to the indifference functions. The first derivative at any particular point on one indifference curve yields the discount rate for that level of (consumption) income [Hirshliefer, 1961; Marglin, 1963-b; Feldstein, 1964]. Income in any period is a function of (a) the level of investment in the previous period and (b) the rate of return on investment in the previous period. Thus, the level of income and the interest rate depend upon the growth rate of the economy. In general, if the indifference curves are convex, a higher growth rate will involve a higher rate of discount. A higher level of income, ceteris paribus, will involve a lower discount rate.

The opportunity cost of capital (OCC) approach, on the other hand, is more directed towards the role of allocating capital between the private and public sectors. This approach is largely concerned with achieving static efficiency in the use of scarce capital. Even if the "social" rate of discount is below the market rate, it is argued, the use of scarce

resources in public investments yielding a rate of return equal to the STP rate while private alternatives exist having higher rates of return fails to achieve either static efficiency or to achieve maximum growth from the invested capital. This is, again, the application of Neo-classical allocation theory [Baumol, 1971; Mishan, 1971].

In simplistic terms, the disagreement between those advocating the STP rate and those favoring the OCC rate has revolved around the problem of optimal growth versus static efficiency. Proponents of the OCC approach argue, that, especially in the face of capital scarcity, forcing the rate of return in one sector to a level below that in another sector violates the principle of second best.[11/] The problem arises because government revenues come not only from private consumption but also from private investment. This "displacement' effect [Marglin, 1963-c] is the subject of the OCC approach. Thus, Baumol argues,

> It follows almost immediately that the correct discount rate for the evaluation of a government project is the percentage rate of return that the resources utilized would otherwise provide in the private sector, [1970, p. 274].

Baumol [1971] and Stockfish [1969] provide conceptual approaches for determining the opportunity cost of resources taxed away from the private sector. These approaches are essentially the same. A weighting system is developed in which the OCC rate derived depends upon the marginal rate of return in each taxes sector and the proportion of total tax revenue coming from that sector. The "rate of return" on consumption is treated as zero.

[11/] For the exposition of the "theorem of second best", see Lipsey and Lancaster [1956].

The OCC approach has been recommended by various authors [Krutilla and Eckstein, 1958; Huffschmidt, et. al., 1961; Baumol, 1971; Stockfish, 1969; Hirschliefer, et. al., 1960]. In summation, the common element is the belief that the rate of return on the government investment should be at least equal to the average rate of return on the private investments foregone to finance the public investment.

The third approach to determining the discount rate for public investment combines the STP and OCC approaches into the "social opportunity cost" (SOC) approach. This approach has been advocated by Eckstein [1957, 1958, 1961]; Steiner [1970]; Marglin [1963-a, 1963-b, 1963-c, 1967]; UNIDO [1972]; Little and Mirrlees [1969]; Feldstein [1964, 1970] and Sen [1961]. The SOC approach involves determining the present value of all consumption--present and future--foregone by transferring resources to public use. "The important effects of the direct and indirect reductions of private investment are explicitly recognized," [Feldstein, 1964, p. 114]. This is done by estimating not only the future consumption stream generated directly by foregone private investment, but also the indirect consumption generated by the reinvestment of part of the returns from the investment. This is counterpoint to the OCC approach which ignores the reinvestment component of the returns.[12/]

A second component of the SOC approach that some OCC advocates (e.g., Mishan [1971]) find disturbing is the use of the STP rate in discounting

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[12/] Actually, the OCC approach need not ignore reinvestment. The same effect is realized if the STP rate is (assumed to be) equal to the OCC, in which case the indirect consumption is discounted at the same rate as the rate at which it grows. Under those circumstances, it makes little difference to the present value whether the returns are consumed or are reinvested.

the direct and indirect consumption foregone in determining the SOC rate. The procedure involves (1) estimating the time stream of the direct outputs of the private investment(s) foregone, (2) determining the portion of the output which will be consumed and the portion which will be saved and reinvested, (3) determining the rate of return on the reinvested portion, (4) determining the time stream of the direct-indirect consumption generated from investment and reinvestment and (5) discounting the consumption stream using the STP rate. Thus the SOC approach involves determining both the OCC and the STP rate (for every year of the project's life).

The STP rate will normally be lower than the rate of return on investment and reinvestment. Thus, a lower rate is used in discounting the outputs than is involved in compounding them. This has the effect of raising the social opportunity cost of capital above the cost which would prevail if the incremental rate of return were used in discounting the alternative consumption. This procedure yields a "shadow cost" for public investment. This shadow cost is compared to the present value of the stream of consumption generated by the project and by the reinvested income from the project, discounted at the STP rate. Thus, the problem is to build a project whose (present value) effects on consumption, in total, exceed those from the alternative private use of the funds.

There are two practical difficulties involved in the SOC approach. First, there is the conceptual problem involved in estimating the social time preference function. Second, there is the empirical problem of determining the incidence of incomes, differences in marginal propensities to save between individuals and sectors and differences in incremental investment alternatives available to each alternative income source and recipient. Both problems are monumental.

Shadow Pricing Labor[13/]

The pricing of labor in project appraisal constitutes an attempt to determine the changes in (societal) welfare involved in employing additional labor in project activities. As discussed throughout this paper, welfare changes are extremely difficult to measure because of both the conceptual problems involved in defining a welfare change and the empirical difficulties of determining actual economic and physical changes.

The attempts to derive a shadow price for project labor transferred from agriculture can be classified as follows:

(1) the opportunity cost approach,

(a) the marginal product of the worker in agriculture,

(b) the output foregone in agriculture,

(2) the supply price approach,

(3) the social cost of labor approach.

The opportunity cost of labor (OCL) approach attempts to measure the welfare costs to society in terms of the output lost by transferring a laborer from the agricultural sector. The marginal product approach determines the opportunity cost to be equal to the marginal product of the worker transferred. In cases of "surplus labor", it has been argued that such costs were zero [Lewis, 1968; Fei and Ranis, 1964]. That is, the worker was redundant in a productive sense and his wage (share) represented solely a distributional component. Transferring the worker out of agriculture (1) left output the same and (2) increased the consumption levels of those remaining.

13/ The assistance of Peter Matlon in the preparation of this section is gratefully acknowledged.

In cases where the marginal product is positive and is used as the relevant opportunity cost of labor, it is assumed that the hours worked by remaining workers (family members) is invariant. That is, the actual output lost and the marginal product of the transferred worker are equal.

Sen [1966] and others (Stiglitz [1967], Berry and Soligo [1968], Wellisz [1968], Knight [1971] and Wonnacott [1962]) have challenged the presumption that the marginal product of the transferred worker and the output foregone are equal. There are three reasons the two might differ:

(1) If the level of consumption in the household were very low and the departure of one laborer (where AP>MP) would raise the consumption levels of those remaining, the marginal product of labor might increase because of the increased work capacity of those remaining [Wonnacott, 1962]. In this case, output foregone would be less than the marginal product of the laborer lost, since the increased consumption would increase their marginal product. This is a special case which would hold only under very low levels of consumption.

(2) If the loss of one laborer increases the level of consumption of those remaining (again, AP>MP), the marginal utility of consumption will decline. The process of equating the marginal utility of consumption with the marginal disutility of work will lead to a reduction in hours worked and a reduction in total output [Sen, 1966]. In this case, output foregone will exceed the marginal product of the laborer lost.

(3) The transfer of labor out of agriculture will shift the terms of trade in favor of agriculture, thus raising the marginal revenue product of labor [Dixit, 1971]. The labor input per

worker will increase. Thus, output foregone will be less than the marginal product of the worker lost. This will not hold for agricultural projects, however, since the projects will normally increase agricultural output.

Lal [1973] has pointed out that using the output foregone as the relevant cost of labor ignores the increase in total disutility of work by those remaining on the farm. In a welfare sense, the difference between the marginal product of labor and the product of the marginal laborer[14/] is not costless. If one accepts the private valuation of this disutility as the relevant social value, then a subtraction must be made from the output foregone to reflect this cost. Lal argues, however, that the social value of the marginal disutility should be valued at zero, even though the private valuation of the marginal disutility is above zero.

A second approach to pricing labor uses the supply price of labor (SPL) as the relevant measure of welfare costs. This approach is most convincingly presented by Harberger [1971] who argues that the supply price of a laborer represents the price at which he is just able to meet the out-of-pocket, opportunity and psychic costs of accepting employment in the project activity. In the absence of externalities (and accepting the philosophy of individualism) the supply price of labor provides a good measure of welfare change, since it includes consideration of (1) the alternative employment opportunities, (2) the direct costs of the new job, e.g., relocating, commuting, higher living costs, etc. and (3) the

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[14/] If the marginal disutility of labor functions are all curviliner adding one hour of work per day to each of eight laborers does not necessarily yield an increase in total work disutility equivalent to that realized by adding one more laborer who works eight hours per day.

difference in disutility of effort between the alternative employment and the project job.

While the Harberger supply price of labor (SPL) is presented in the context of individualism and the welfare ethic which accompanies this philosophy, it turns out that the approach is equally correct in many extended family systems. In much of Africa, for example, the decision to seek and accept employment off the family farm is usually a group decision, arrived at after the individual has discussed the issue with the older members of the family. Unless the project wage equals or exceeds the family welfare cost of the individual's leaving the farm, the family ostensibly would discourage his transfer of labor.[15/]

The third approach to shadow pricing labor is the "social accounting price" (SAP) which incorporates into the shadow price of labor the relative values of saving and consumption. This approach grows out of social benefit-cost analysis, where programming prices are deemed to under-value the social cost of consumption vis-a-vis saving. The belief that labor costs should be adjusted for saving suboptimality revolves around three issues:

(1) The rate of saving is socially suboptimal and present consumption is over-valued relative to future consumption.

(2) The proportion of wage payments consumed exceeds that of profits and interest.

[15/] For a discussion of decision-making and resource allocation under extended family farming, see Sen [1966] and Wellisz [1968]. This point was clarified in a discussion of these issues with Simon Mbilinyi and Peter Matlon. This section has profited greatly from their comments.

(3) Projects represent the only means by which government can affect the rate of saving.

The SAP approach is attributable to Little [1950], Little and Mirrlees [1969], Marglin [1967], UNIDO [1972], Eckstein [1957] and Galenson and Leibenstein [1955].

The SAP incorporates considerations of output foregone, increases in consumption by project labor and the value of consumption relative to saving into a shadow price for labor. Normally, the SAP will be between the marginal value product and the market price, though with "full employment" and sub-optimal saving the SAP might exceed the market wage [Lal, 1973].[16/]

Formulations of the SAP include an intertemporal component via the shadow price of investment [UNIDO, 1972; Marglin, 1967]. Since wages (i.e., consumption) reduce the rate of current investment, which affects future production and consumption, the SAP includes consideration of the time stream of alternative future consumption generated. The standard formulation of the SAP is based upon two objectives--growth versus efficiency. Addition of income distribution objectives changes the SAP, since consumption to lower income individuals is valued more highly than income to capitalists. Since the income from capital-intensive projects accrues to capitalists, the addition of income distribution weights will reduce the SAP, the degree depending upon the progressivity of the weights. UNIDO [1972] and Little-Mirrlees [1969] discuss the effects of income weights on the analysis, while Lefeber [1968] indicates that labor shadow

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[16/] It is also possible to derive a negative shadow wage, where income distribution weights are assigned.

prices should perhaps be adjusted for the higher social value of consumption to low income individuals.

The "appropriate" shadow wage will depend upon the objectives sought. If "efficiency" is the only objective, the supply price of labor will provide the best estimate of the welfare costs in both the individualistic society and extended family ethic, if there are no major externalities. If efficiency and growth are dual objectives, the SAP will be the "appropriate" shadow price for labor. The difficulties are great, however, in both conceptual and practical terms. First, a social time preference rate (function) will be required. Its determination presents particular conceptual problems. Second, the accounting price of investment entails a very difficult practical problem in determining the reinvestment rates and the rates of return on investment, in addition to the conceptual difficulties.

The addition of income distribution and/or employment objectives indicates a different shadow wage. Such a price would involve a simultaneous determination by political authorities of the relative values of efficiency, growth and income distribution. To specify an objective function of the type implied in optimal growth models would require an "optimal distribution growth" model.

While an optimizing model for multiple objectives is currently impossible, it is perhaps possible to determine the direction one should go in accomodating income distribution objectives. The optimal location on the multi-faceted social welfare frontier is , of course, very difficult for the economist to determine. Since the prices used in project preparation and appraisal help determine this location in n-dimensional welfare space, the economist's role is first one of advising policy makers of the implica-

tions of certain prices. Using the SAP implies decreasing the labor-intensity of projects. The relevant issue is whether decreasing labor-intensity will increase the growth rate. This issue can only be resolved by determining whether the basic assumptions of social accounting pricing hold in general. Research directed towards this question is suggested in section III.

Indirect Benefits

Definition

The most confused topic in the project appraisal literature is that of indirect benefits or secondary benefits. Part of the confusion is terminological and part is an outgrowth of the differences between economies: literature addressed largely to the United States water program is often accepted as directly relevant to developing countries, which is seldom the case. The first group of benefits (the indirect) categorized below are usually assumed to net out to zero in the United States case, while in most developing countries positive indirect benefits do occur for many projects. However, they are usually considered to be too difficult to trace down, particularly where projects are so scarce that most projects meet the choice criterion on their direct benefits alone.

Though Masse [1970] differentiates between secondary and indirect benefits, it is better that his distinction be ignored, since it does not conform to the most important distinction. The terminology used herein differs from that of Masse. The term secondary benefits will be used to encompass what I shall call indirect benefits (category one). Secondary

benefits will refer to all other benefits not included in the usual efficiency approach to project appraisal. Each of these has a name of its own, however, which can be used in distinguishing it from other forms.

Basically, the need for terms such as "secondary" and "indirect" grew out of two failings of conventional efficiency benefit-cost analysis. First, because only one objective was considered in the formal appraisal, a catch-basket was needed for the other relevant impacts. Thus, secondary benefits grew in part from the lack of a multi-objective framework. Secondly, since conventional project appraisal is strictly partial equilibrium, it ignored many interdependencies and indirect effects on other parts of the economy. Thus, indirect benefits represented an attempt to move project appraisal towards a more systems oriented approach of general equilibrium analysis. The following categories[17/] of secondary benefits can be identified:

(1) Indirect benefits.

(a) Induced-by benefits indicate the increase in incomes earned by those indirectly supplying inputs to the project.

(b) Stemming-from[18/] benefits which indicate the incomes earned by those involved in production or marketing processes using the output of the project (e.g., income earned by workers in poultry processing resulting from a poultry production project).

(c) Household responding multipliers which indicate the change in income indirectly resulting from the respending of income

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[17/] Kneese [1959] gives a similar breakdown of categories.

[18/] Often the term backward-linked is used synonymously with induced-by and forward-linked is used synonymously with stemming-from.

earned by income recipients in (a) and (b) above. This income is alternatively called "household-induced" or "Keynesian-induced" income.

(2) Externalities (see Margolis [1957]).

(a) Economies of scale in some production process arising from increased demand created by the project or from the increased availability of some factor whose supply is augmented by the project.

(b) Technological spillovers, such as the increased production of warm water species of fish below a steam electric plant or the increased production from orchards resulting from improved pollination caused by a bee-keeping project.

(3) Dynamic secondary benefits such as X-efficiency add O-efficiency which affect the shape and form of the aggregate production function. "Improved" attitudes toward work is one such effect considered under this heading [Kneese, 1959].

(4) Intangible, "noneconomic" effects such as lines saved, reductions in human misery resulting from disease eradication, etc. Under this heading would fall the equity considerations of projects impacting low-income families.

In addition to the categories included above, Marglin [1966] includes the consumers' and producers' surpluses generated from expanded production. Mishan [1972] and others have viewed these surpluses simply as components of direct benefits, however.

The development of linear macroeconomic models has led towards the implementation of the category "I" effects, which are labeled "indirect benefits". Nonlinear models are required to implement the benefits arising

from economies of scale and socio-psychological models are required in implementing categories "III" and "IV". Most of the attempts at implementation have focused on the indirect or multiplier effects. The Water Resources Council Guidelines [1969] focused upon categories "I" and "II", but they did not give workable guidance regarding techniques for estimating impacts from externalities.

The tendancy to focus on the indirect benefit component when discussing secondary benefits has led to the interchangeable use of the terms and has created some confusion among analysts. The preferred term for category "I" benefits is "indirect benefits", since it is more specific than the term "secondary benefits", which refers to categories "I" through "IV" and is all-inclusive. The term "indirect" also conforms most closely with the terminology of "regional scientists", from whom most of the models for estimating indirect impacts of projects come.

The most relevant benefit category to the topic discussed herein is that of indirect benefits, including the induced-by, stemming-from and household-induced varieties. These have also been the subject of most of the literature on secondary benefits.

The conclusions regarding the likelihood of indirect benefits (largely relating to United States cases) have been mixed, in large part due to the fact that the topic was addressed in the context of only one objective--efficiency. Accepting efficiency as the only objective implies that employment is optimized simultaneously and that factors move to their highest uses automatically. The basic ideas of Keynesian analysis and of indirect benefits are opposed to this Neo-classical conclusion, however. Thus, for three decades benefit-cost analysis grappled with the problem of incorporating Keynesian analysis into a model which was in theory Neo-classical.

As a result, some of the most confusing of the benefit-cost literature was addressed to the topic of indirect benefits. The following sub-sections seek to address this fundamental problem of conflicting appraisal models.

Nature of Indirect Benefits[19/]

Indirect benefits occur because of the existence of underutilized resources. Thus, they are related to shadow prices by virtue of the discrepancy between the opportunity cost and the market price of resources employed at the margin.

Indirect benefits can arise from the employment of previously unemployed resources or from the shifting to higher levels of employment of underemployed resources. Two types of resources are usually considered--labor and capital, with labor being the most important and the most widely analyzed.

There are two basic causes of resource unemployment and underemployment: (1) a deficiency of aggregate (final) demand and/or (2) market distortions such that derived demands for factors are not transmitted smoothly through the economy. The latter are often discussed as "bottlenecks" to (indirect) economic expansion and may occur because of supply restrictions for critical inputs. Thus, three forms of the indirect benefit concept become immediately relevant: one for final demand changes, one for derived demands and one for supply effects. These are, respectively, the household induced (i.e., the familiar Keynesian) multiplier effects

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[19/] This section follows closely Ward [1972], chapters II and III and is an extended form of the discussion in Gittinger [1972, pp. 24-29].

of government expenditures, the induced-by (derived) demands for unemployed or underemployed factors and the stemming-from effects on the supply of factors (the shortage of) which hold up the transmission of final demand to other unemployed complementary factors.

The market distortions which create bottlenecks to derived demand transmission can be of three forms: (1) supply restrictions, as discussed above, (2) factor immobilities imposed by "asset fixity" and (3) factor price distortions created by government policies such as minimum wage laws.[20/] Indirect benefits concepts in the United States are applied to supply restrictions (stemming-from benefits), factor immobilities (induced-by benefits) and sometimes to aggregate demand deficiency (particularly of a regional nature where regional income is a project objective).

Indirect benefits do not exist with full employment and perfect competition [Eckstein, 1958; McKean, 1958] since all factors are paid their marginal opportunity cost under those conditions and no "higher" use exists for each of the resources. However, where less than full employment and/or imperfect competition exists, indirect benefits can be generated by increasing the demand for these resources. In both cases--i.e., unemployed resources and resources employed in imperfectly competitive industries--the increased demand for those resources will generate "rents" which form the heart of indirect benefit analysis. For unemployed or underemployed resources, the rents are represented by the difference in real factor earnings with the project over those without the project. For project labor,

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[20/] Note that factor price distortions will occur in the case of factor immobilities also. These are particularly relevant in the case of interregional mobility of labor, where regional preferences and ignorance of alternatives will lead to underemployment of labor in one region at the same time that excess demand for labor and consequent higher prices exist in other regions.

for example, the rents are represented by the project wage minus the alternative wage--the presumption being that these differences represent the difference between relative contributions to national income with and without the project.[21/] For unemployed or underemployed capital resources, the quasi-rents generated represent the indirect benefits. Since quasi-rents include pure profits, indirect benefits flow directly from project which stimulate production by imperfectly competitive firms [Marglin, 1966].[22/]

The difficulty with quasi-rents which emerge from imperfect competition is that marginal cost will continue to diverge from marginal social value (or demand) even after the project has stimulated an increase in output. Efficiency analysis avoids value judgements on the distribution of project indirect benefits. Increased income which accrues to monopolists is viewed equally socially desirable with that which accrues to unskilled labor or to other resources. Imperfect competition also causes more difficulty in valuing the benefits stemming from a project's output. Because the firm using the project output restricts the stemming output to maximize profits, the marginal value product of the project output in the production process (i.e., the MPP x MR) will be less than the marginal social product (i.e., MPP x demand price). The use of market price for the value of the

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[21/] For a discussion of the theoretical arguments underlying the assignment of an opportunity cost to pre-project labor, see the preceding section on "Shadow Pricing Labor". The indirect benefit approach makes national income changes the relevant measure of welfare.

[22/] Since firms in imperfect competition normally have unused capacity, the possibility of greater capacity utilization exists in these sectors even when "full employment" conditions exist nationally. In theory, the full utilization of plant and equipment can be generated in the short-run but imperfect competitors in making long-run adjustments will increase plant capacities so that new higher levels of demand can be met in a lower unit cost plant operating at less than "capacity" and realizing pure economic profits.

project output will thus understate the real social value of the project output.[23/]

Multiplier Analysis of Indirect Benefits

The most obvious case in which quasi-rents (or indirect benefits to labor and capital) will emerge is where "Keynesian" unemployment[24/] exists. Since the opportunity cost of labor and capital are presumed to be zero, then all of the factor payments to labor and capital are presumed to represent net additions to national output. The total additions to national output are estimated by using income multipliers which estimate the direct and indirect factor payments (or "value added") resulting from an exogenous increase in demand. So long as the multiplied income does not exceed the unemployed productive capacity, the multiplier effect will represent a real increase in total output. This is true because of the almost perfect elasticity of supply under "Keynesian" unemployment. All spending is considered beneficial and is assumed to represent real changes in national output and income. In the Keynesian case, only two factors limit the opera-

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[23/] Market imperfection creates other difficulties in analyzing stemming-from benefits. These will be discussed below after certain other concepts and techniques are introduced. Much of the remaining discussion will abstract away from the problem of resource allocation posed by marginal cost diverging from marginal social value, where marginal social value is defined as the demand price, rather than marginal (private) revenue.

[24/] Keynesian unemployment is defined as unemployment resulting from a deficiency of demand. Such demand deficiencies emerge either from overall macro-economic deficiencies or from market imperfections which lead to a failure to transmit final demand to factors of production, as discussed above.

tion of the multiplier: (1) the range of output over which supply is elastic and (2) leakages from the spending stream. Only the latter is formalized into the Keynesian multiplier. Thus, it (and its later counterparts) are aggregate demand multipliers. That is, they measure only the increase in aggregate demand. The application of these multipliers to estimate indirect benefits assume that (1) aggregate supply is perfectly elastic and (2) that all factor payments accrue to recipients as "rent"--i.e., that the factors would have been available at any price above zero.

Induced-by "Benefits". Induced-by benefits fit most neatly into the efficiency appraisal model, for they are a counterpart to the shadow pricing of inputs. Indeed, where efficiency shadow prices for labor are used in project appraisal, it is inconsistent to price complementary inputs at market prices, if labor is used in producing the inputs. If unemployment or underemployment exists, as is indicated by shadow pricing project labor, the opportunity cost of the labor used in producing project inputs might also be overstated by their market price, in which case the market price of a project input overstates the opportunity cost of the resources used in its production. In theory, project costs should be stated in terms of the opportunities foregone by using resources in the project. Thus, project inputs other than labor should be shadow priced according to the production opportunities foregone.

If the inputs used by the project are bid away from uses in which their marginal value products (MVP's) are marginally lower (as occurs in the Neoclassical model), then the market price represents the real opportunity cost. However, if there was not a marginally lower alternative available, then the

inputs should be valued according to the higher of (1) the MVP in the best alternative use of the inputs or (2) the opportunity costs of the resources used in producing the inputs. The induced-by multiplier assumes that the latter is the higher.

Induced-by income multipliers represent an application of the national income accounting concept of valuation at factor cost. The sectoral multiplier thus derived tells the proportion by which the price of the outputs of that sector should be reduced to reflect the (assumed) zero opportunity costs of labor, management and entrepreneurship. Thus, in project appraisal application induced-by "benefits" (income) really should be treated as cost reductions rather than benefits.[25/]

The induced-by income is derived by developing a "type I multiplier" (see Hirsch [1959]) which traces the final product demand through each backward-linked round of inputs required and computes the value added accruing in each round. The use of the income thus derived as a "benefit" (or as a reduction in cost) assumes that the resources to which the value added accrued had opportunity costs of zero.[26/] These include the resources of labor (skilled and unskilled), management and entrepreneurship. This is, of course, a ridiculous accounting of opportunity costs as a general application, which explains in large part the reticence of most economists to condone the general application of "indirect benefit" concepts.

[25/] Under the internal rate of return criterion, it makes little difference how they are treated, except for those induced-by "benefits" which come from construction expenditures. Under the benefit-cost ratio, criterion, the distinction is important, since the ratio will be affected by changing both the numerator and denominator by equal amounts.

[26/] If the Harberger [1971] formulation for pricing labor is used, the procedure discussed above assumes that the supply price is zero.

A more reasonable approach involves disaggregating the value added into its component parts and subtracting estimates of each component's opportunity cost before estimating the actual "rents" which accrue directly and indirectly.[27/] If properly estimated, these "rents" constitute legitimate deductions from project costs in efficiency analysis.

Stemming-from "Benefits". Stemming-from benefits have been defined as the increased income in forward-linked firms resulting from increased supply of output attributable to the project [United States Water Resources Council, 1969]. The project's output is viewed as a "bottleneck" to the expansion of forward-linked output. The usual example of a forward-linked industry subject to stemming-from benefits is the food processing industry.

In the general application, the increase in value added accruing to firms which process project output is viewed as a benefit stemming-from the project. Attributing forward-linked income to the project makes several questionable assumptions.

First, stemming-from benefits assume that there is no alternative use for the labor, management and entrepreneurship used in conjunction with the project's output (or that those complementary resources would be forthcoming at a zero price). Secondly, it assumes that no other inputs will substitute for the project's output in the forward-linked production process. Thirdly, the market price of the project's output is presumed to undervalue its MVP by the amount of the value added generated in forward-linked production.

[27/] This technique is developed in Ward [1972].

In the efficiency analysis of projects, the process of estimating "stemming-from benefits" is one of estimating the extent to which the price of the project output understates its real marginal value product in forward-linked production processes. Stemming-from "multipliers" do not generally estimate this difference accurately. Indeed, a strange result occurs in industrial applications of stemming-from analysis, since industrial intermediate products normally do not make up such a large part of input costs to forward-linked firms as do agricultural products.

The disturbing thing about stemming-from income is that the size of the multiplier is immensely related to the importance of the project's output in the forward-linked sectors. In input-output terms, the smaller the direct requirements coefficient for the project output in the forward-linked sector, the larger will be the income "stemming-from" the project.[28/]

In general, stemming-from multipliers should not be estimated in efficiency analysis of projects, unless the assumptions spelled out above are met. These are very stringent conditions which would seem to rule out most situations. This is not to deny the possibility of the project output's price differing from its MVP. Rather, it is felt that the means generally used in estimating stemming-from income is not a good means for estimating these differences between market price and MVP.

Where projects are appraised in a general equilibrium framework, the analysis of stemming effects becomes more relevant. Clark, et. al. [1952] have referred to induced and stemming effects as demand and supply effects, respectively, which should not be summed in valuing benefits. They are at least partly correct in their position. However, the supply effect is upon

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[28/] For fuller development of this point, see Schmid and Ward [1970] and Ward [1972].

the forward-linked sectors, while the demand effect is on the backward-linked sectors. The forward effect (supply) presumes a final demand for the forward-linked output, which is either (1) unrequitted because of the "bottleneck" posed by the project output or (2) created by the aggregate demand-increasing effect of the project. The backward-linked effect presumes that supplies of inputs would be forthcoming if there were a demand for them. Thus, the induced effects can arise for two project-related reasons: (1) the project's output is a bottleneck to the backward transmission of final demand or (2) the public expenditures on the project increase aggregate demand so as to employ resources which were previously experiencing "Keynesian" unemployment--i.e., unemployment resulting from deficient aggregate demand.

In the partial equilibrium analysis implied in efficiency analysis, the supply and demand effects are for different products. If the "rents" generated are measured correctly, as discussed above, then they may be added in determining the net addition to benefits above the "direct" project benefits. In actuality, however, correctly-measured stemming effects should be treated as benefits, while induced-by effects should be treated as reductions in cost. In efficiency analysis, they are shadow price adjustments for outputs and inputs, respectively.

Household-induced "Benefits". The position taken by Clark, et. al. [1952] is more appropriate where projects are appraised in a general equilibrium framework and where macro-economic policy is deliberately made simultaneously. It should be obvious that this is not currently the general case.

In the aggregate sense, the stemming-from effect is a supply effect, but the relevant demand effect is the effect on final demand. The final demand effect comes via the household-induced component. Thus, the addition of stemming income and household-induced income does constitute double-counting of multiplied income, unless two very strange conditions exist: (1) there is a demand for the forward-linked output already, but it is thwarted by the "bottleneck" posed by the project output but (2) there is isolated demand deficiency for the products forwhich earners of induced and stemming value added will respend household income. That both conditions would exist simultaneously would appear unlikely. Further the ability to detect and estimate the existence and extent of such conditions is currently not possessed by project appraisors. Generally, one would not expect stemming and household-induced income to be additive. Household-induced income should, thus, not be considered a "benefit" in efficiency analysis of projects, which is a partial equilibrium method.

Indirect Benefits Under Social Benefit-Cost Analysis

The addition of growth as a project objective, however, brings household-induced income into the appraisal model and adds the dynamic component of household-induced investment. Consumption expenditures by households are treated as final ends. Investment (or saving) is treated as a means for achieving future consumption. Thus, the addition of growth as an objective involves estimating the household-induced investment, with consumption treated as the "leakage", rather than the other way around. This leads to a strange mixture of partial equilibrium with a dynamic

component in social benefit-cost analysis (i.e., in efficiency-growth analysis). Because household consumption spending effects are left out, the approach is a sub-optimizing approach--i.e., project planning and macro-economic planning are not simultaneous. However, projects are appraised in terms of the long-run effect on consumption rather than merely their short-run generation of income available for consumption (see Little and Mirrlees [1969] and UNIDO [1972]). When the consumption occurs, it is viewed as a "leakage" since it does not make available additional consumption. It is discounted back to project year zero, using the social time preference rate. This "indirect" consumption has a value greater than the consumption value of the income which was invested to yield it because the rate of return at which it was invested (the market rate) exceeds the rate at which it is discounted (the social time preference [STP] rate).

Social benefit-cost analysis implicitly involves "indirect" benefit analysis, but is of a vastly different kind from that covered in the traditional literature on (efficiency) indirect benefits. Much of the traditional literature[29/] uses multiplier analysis--in particular, input-output multipliers--which is "timeless" in approach. In effect, the traditional approach viewed consumption and investment as equally valuable. This is justified where the "market" rate of interest equals the social time preference rate. Where it does not, then time must be brought into the analysis. The most wisely-used current models for estimating these effects are the input-output models. However, input-output analysis abstracts away from the problem of duration of rounds of spending. It says nothing regarding when value added is generated or how long it takes to

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[29/] See the compendium of papers published in United States Department of Agriculture [1970], for example.

carry out investment dynamics. Thus, social benefit-cost analysis requires more information than that available from standard input-output models.

III. RECAPITULATION OF CONCEPTUAL ISSUES

In Section II, three approaches to project appraisal were identified:

(1) efficiency benefit-cost analysis

--uses market prices or shadow prices
--only one objective is considered--national economic efficiency

(2) social benefit-cost analysis

--considers two objectives: efficiency and growth
--presumes that saving is sub-optimal because the market rate of interest exceeds the social time preference (STP) rate of discount
--uses shadow prices which include a social premium on saving and discounts the value of present consumption

(3) multi-objective benefit-cost analysis

--considers several objectives
--may use market prices, programming shadow prices or "politically-derived" shadow prices

(a) the decision matrix or impact matrix approach
--objectives are unweighted
--may use market or shadow prices
--project impacts on different objectives are listed under separate accounts for each objective

(b) the constraint approach
--may use market or shadow prices
--one or more objectives are constrained while one objective is maximized subject to those constraints
--yields implicit weights on each objective vis-a-vis other objectives

(c) multi-objective benefit-cost analysis
--overtly weights each objective
--uses "social" prices reflecting outputs and costs in terms of effects on all objectives.

In each case, the method of determining the shadow or accounting prices depends upon the objectives pursued. In principle, all objectives included on the benefit side must be included on the cost side. Thus, shadow pricing the factors must reflect the cost of those factors in terms of their foregone effect upon each objective.

Efficiency benefit-cost analysis is the simplest to apply since it includes only one objective. Roughly translated, that objective is maximum real national income. In the absence of externalities or market price distortions, market prices can be used in valuing inputs and outputs. Where distortions exist, "equilibrium" prices which would exist without the distortions can be estimated (in theory) using programming models.

Social benefit-cost analysis is more difficult because it includes two objectives: national economic efficiency and growth. The growth objective is added in a social sense, saving is too low and thus the growth rate is too low. A project's worth is assessed in terms of its contributions to the present value of aggregate consumption. Since $R > i$ (where R = the rate of return on investment at the margin and i = the social time preference rate), projects whose benefits accrue to savers receive a premium over those whose benefits accrue to consumers. The present value of aggregate consumption is greater for savings-creating projects, because the rate at which future consumption is discounted is less than the rate at which it grows under private sector investment at the margin. All factor prices include a consideration of their implications for creating savings. The procedures for computing these prices require knowledge of:

(a) the rate of return on private investment at the margin for the sources of funds used in projects,

(b) the marginal propensity to save by different recipients of project income and

(c) the social time preference rate of discount.

Topic (a) involves an empirical question which can be answered by research on the source and alternative use of funds secured for building projects. If all funds are taxed away from consumption, the problem

dissolves. No alternative future consumption is foregone and the project cost accurately reflects the present value of consumption foregone. If, however, part of the funds are diverted from private sector investments, the social cost will be higher than indicated by the financial cost. Determining the rate of return on these investments is subject to empirical estimation.

Topic (b) involves both conceptual (i.e., theoretical) and empirical issues. The empirical question of the portion of marginal income saved is best answered in the presence of a general theory of saving behavior. Mikesell and Zinser [1973] indicate that currently available evidence from developing countries does not wholly support any of the three major hypotheses of saving propensities--the absolute, relative and permanent income hypotheses. Since the latter two, which have some intuitive appeal involve interpersonal externalities, the estimation procedures get precarious. A prerequisite for determining the empirical part of the question is the answering of the theoretical question.

Topic (c) is at present wholly a theoretical question, completely wrapped up in the larger issue of interpersonal welfare theory. Some would deem it unanswerable, even conceptually. Unfortunately, the whole of social benefit-cost analysis is bogged down by the discourse over the relevant social time preference rate (or, more properly, the STP "function").

Multi-objective benefit-cost analysis which includes employment and income distribution as objectives in addition to efficiency and growth are even more difficult to apply than social benefit-cost analysis. In applying this form of multi-objective analysis, the following additional information is required:

(1) the labor income generated in the alternative use of the project costs (directly and via reinvestment), by income level of the income recipients,

(2) the marginal propensity to save for each income group,

(3) the rate of return on investments available to each income group,

(4) the social weights to be applied to income (or consumption) accruing to each income group.

Topics (1) through (3) are largely empirical questions, answerable by disaggregated macro-economic modeling. Topic (4), on the other hand, is closely akin to the STP rate problem. It requires a "social" valuation for which welfare theory does not supply an applicable model.

There are two major practical problems in applying social benefit-cost analysis. First, the absence of the data outlined above has forced the use of "guestimates" of the marginal propensity to save (MPS), the social time preference (STP) and the rate of return on alternative investments. (Alternatively, ranges of estimates have been used and sensitivity tests of "switching values" run.) Secondly, since this approach usually reduces the benefit-cost ratio of public investments, it would suggest the exclusion of some projects which pass efficiency criteria at both shadow and market prices. Under conditions of "project scarcity" the exclusion of the only available project alternative would sometimes result. The net effect of the whole process at times appears to argue for reducing government spending for projects and transferring the funds to private entrepreneurs having a high MPS and good investment alternatives. The second possibility is to construct projects which transfer income to those same individuals.

The major difficulty with social benefit-cost analysis is that, in practice, it may lead to investment programs which worsen the income distribution because of the implicit assumption that saving propensities are higher among higher income individuals. If growth is the objective, income is transferred to those individuals having high income.

Applying weights in multi-objective analysis to the incomes of different individuals offsets part of the effect of the different marginal propensity to save. Thus, while growth objectives bias shadow prices towards high social prices for labor, applying higher values on low income consumption biases them back towards their efficiency counterparts. In the absence of a disaggregated model of growth, the tradeoff for the offsetting factors cannot be determined. All one can say is that the greater the weight put upon growth relative to income distribution, the higher the shadow prices of labor and investment.

In the face of the usual shortages of data, the analyst has difficulty in determining the shadow prices to apply in practice. Thus, the task in the short run is to develop a "satisfying" model for project appraisal. There are three issues which must be faced.

First, alternative pricing schemes which do not use market prices potentially violate the principle of second best. That is, the use of lower-than-market shadow wages in public projects means that national output could be increased by transferring labor to private sector employment where its marginal value product is higher.

Second, efficiency benefit-cost analysis will maximize present output, since it considers the static opportunity costs of the factors involved. Additionally, if the market rate of interest equals the "correct" constellation of the social time preference rate from individual time preferences,

efficiency analysis will also contribute to optimal growth. The difference between the STP and market rate, however, is indeterminable. Thus, we cannot estimate the extent to which efficiency analysis leads away from optimal growth. All we can say is that efficiency analysis contributes to the achievement of static efficiency.

Third, social benefit-cost analysis takes us away from efficiency analysis, while income distribution considerations ostensibly carry us back towards efficiency analysis--both effects by an indeterminable amount. In the absence of data which allow the determination of the magnitudes, the "safe" approach might well be to continue using efficiency analysis while seeking answers to the questions which allow us to move more surely towards a social optimum.

The simple recommendation that emerges from the foregoing is the following: if efficiency, growth and income distribution are project objectives, and if the analyst cannot get the requisite date (including the relative importance of each objective) to apply a multi-objective analysis, the analyst's safest course might well be to use an efficiency appraisal framework with efficiency-based shadow prices. In the section which follows, methods for developing the required data are suggested so that the analysis may move towards the explicit tradeoff of objectives. The starting point in most cases will remain the efficiency approach. Ensuing steps will depend upon the ability of analysts to estimate the important parameters involved in social and multi-objective benefit-cost analysis. Research directed towards estimating these parameters is the subject of the following section.

IV. A RESEARCH PROGRAM FOR IMPROVING PROJECT APPRAISAL: ILLUSTRATIONS FROM ONGOING RESEARCH IN SIERRA LEONE

There are three important categories of research which need to be undertaken before any clear decision can be made relating to the advisability of using social cost-benefit analysis and multi-objective benefit-cost analysis rather than efficiency benefit-cost analysis. These three categories are:

(A) Planning office studies
- (1) The opportunity cost of capital
- (2) Social time preference
- (3) Objective weights (for multi-objective benefit-cost analysis)
- (4) Foreign exchange shadow price

(B) Household and farm management studies
- (1) The marginal propensity to consume
- (2) Returns to investments by income groups
- (3) The opportunity cost of labor
  - (a) Leisure--labor substitution
  - (b) The seasonal supply price of labor
  - (c) The marginal value product of labor

(C) Industry studies (including small scale industries)
- (1) Part-time labor use (including seasonal)
- (2) Direct-indirect requirements of labor and materials.

The research suggested above attempts to address two basic problems connected with project appraisal:

(1) the social choice problem involved in delineating and weighting social objectives (and the "prices" derived therefrom) and

(2) the empirical problem involved in determining the appropriate magnitudes of strategic economic variables.

The social choice problem is both a practical and a theoretical one. The theoretical issues are spelled out in the vast literature on social choice (e.g., see Dasgupta and Pearce [1972]). It involves, in part, the determination of a rudimentary social welfare function. On the practical side,

in most developing countries, if society is involved in the derivation of such a choice function, one ends up with the values of those in government [Oyugi, 1972]. This method is proposed by UNIDO [1972]. Since project appraisal is in essence applied welfare theory, it should be appreciated that project appraisal is no better than the social choice function upon which the appraisal is based.

The second problem is the empirical one of determining the magnitude of certain key parameters that determine whether social and multi-objective benefit-cost analysis yield the same results as efficiency benefit-cost analyses. The difficulty with social and multi-objective benefit-cost analysis, for example, is that the "social" choice of a time preference rate which differs from the "individual" choice rate implied by capital markets forces the use of a "social" accounting price for labor if labor income earners have a higher marginal propensity to consume than capital income earners and/or <u>if</u> the investment alternatives available to the two yield different rates of return. Whether to utilize social and multi-objective benefit-cost analysis or efficiency benefit-cost analysis will thus depend upon the answers to these questions:

(1) Is the social time preference rate different from the "market rate"?

(2) Are the laborers' marginal propensities to consume different from those of capitalists?

(3) Are the rates of return on re-investment by laborers different from those of capitalists?

(4) What are the indirect effects of projects on labor incomes, capital income and import expenditure?

If (1) or (2) is answered negatively, the growth-efficiency dilemma would largely evaporate and the social accounting price for labor would reduce to the efficiency shadow wage. Also, if laborers invest in higher-return projects than do capitalists, the effects of a higher marginal propensity to save by capitalists could also be affected.

The fourth question involves the indirect effects of projects on labor income, capital income and import expenditures. It is quite possible that questions (1) and (2) above could be answered affirmatively, yet labor-intensive projects might still not reduce the growth rate if import leakages from capitalists were greater than those income and expenditures streams involving laborers. This is particularly the case where imports by capitalists are consumption rather than investment goods. The critical issue at stake is the relative import propensities of the two groups. In cases where rural employment generation is an objective, "imports" include expenditures for goods produced in the urban areas. An important question in developing policies for rural employment generation concerns the extent to which indirect employment effects of different projects and programs differ sufficiently to justify the inclusion of indirect impacts in project appraisal. In this case, answers to the indirect employment question must be sought simultaneously with those regarding questions of indirect reinvestment.

The research undertaken by the African Rural Employment Research Network will generate much of the data needed to shed light on many of these problems. The nature and scope of this research effort in Sierra Leone, Nigeria and Ethiopia is described in detail in African Rural Employment Study Working Paper No. 1 [1974]. One may obtain an insight into this research endeavor, however, from a brief examination of the Sierra Leone component

of the research network. In Sierra Leone, five integrated micro-level studies formed the central core of the Sierra Leone research effort: (1) a farm production study, (2) an agricultural marketing and processing study, (3) a rural nonfarm study, (4) a rural consumption and expenditure study and (5) a migration study. The data for all five studies were collected from the same sample of 575 rural households, which were interviewed twice weekly for a period of one year. When subjected to various economic analyses, these data will generate several of the key structural parameters of the rural economy about which previously very little has been known.

The research program of the African Rural Employment Research Network will thus shed light primarily on the empirical rather than the social choice problems mentioned above. Indeed, the key elements of the social choice problem are listed in the Planning Office Studies category (category I) and require additional work at both the theoretical and empirical level. The social choice question is a most important part of the debate on project appraisal and should be the subject of continuing work by economists.

The focus of the research of the African Rural Employment Research Network is centered on the empirical problems listed in the Household and Farm Management Studies category (category II) and the Industry Studies Category (category III), where information is needed regardless of which welfare tenets eventually settled upon. The results of the research of the African Rural Employment Research Network should thus:

(1) provide data from which analyses can be undertaken to determine whether one approach to appraisal leads to different project mixes from those arrived at by another approach to appraisal and

(2) provide primary data from which appraisal can be improved, regardless of which currently discussed method(s) is (are) settled upon.

More specifically, the results of the African Rural Employment Research Network research can be used to estimate the sensitivity of methods used to appraise particular sets of project alternatives. Do social and multi-objective appraisal methods yield different answers from efficiency analysis in situations where sufficient data exist to apply them? Of particular relevance is the labour-intensity of projects, which will depend upon:

(1) the difference in indirect impacts between labour- and capital-intensive projects,

(2) the capital-labor elasticities of substitution between and within the relevant technologies and

(3) the extent to which savings-investment functions differ between capitalists and laborers and (thus) the difference in laborer's shadow price in different appraisal approaches.

Several elements of the African Rural Employment Research Network research program can provide valuable data towards answering many of these empirical questions. In Sierra Leone, for example, an attempt has been made to design each sub-project to link up with other sub-projects to provide not only detailed micro-economic information, but also information on economic interrelations which can be used to ascertain indirect employment and output effects. Moreover, the farm management component of the research undertaken in Sierra Leone, Nigeria and Ethiopia will yield information on seasonal labor supply and opportunity costs and on labor intensity of cropping alternatives, as well as the employment and income impacts of package projects. In addition, the migration research in Sierra Leone, which

attempts to explain rural-urban migration, has important implications for estimating the supply price of labor in rural areas, which has important implications for improving efficiency benefit-cost analysis.

Finally, the research in Sierra Leone on small rural nonfarm enterprises will yield data on seasonal labor utilization and opportunity cost, as well as linking up the farm with the rural nonfarm sector in determining the direct-indirect linkages within the rural economy [Chuta and Liedholm, 1974]. This information, when combined with the Sierra Leone household consumption and expenditure study, will be instrumental in determining the extent to which income received by different income groups will generate rural employment, income and savings and investment.

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