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# Integration of Poverty Impact in Project Economic Analysis:

## Issues in Theory and Practice

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## I. INTRODUCTION

### A. Economic Growth and Poverty Reduction

This paper is motivated by the serious reemphasis on poverty impact in Asian Development Bank (ADB) operations as well as the recent revived interest in poverty issues in development economics. Currently the overall policy paradigm favored by international agencies is that of “pro-poor growth” combined with targeted poverty-focussed interventions. What is meant by pro-poor growth is not straightforward. Most international agencies that aspire to this point to growth that is labor-intensive and which allows the creation of human and social capital for the poor. Discussion on labor-intensity is in itself not without ambiguity as skills and knowledge content of labor input are normally referred to as human “capital,” therefore a reference to labor-intensive interventions would naturally invite a question regarding “what types of labor” are being addressed. However, the greatest ambiguity relates to the context in which pro-poor growth is discussed. Most of the accumulated macroeconomic evidence of the last twenty years concurs with the view that economic growth is essential to sustained poverty reduction. A given rate of economic growth will have an effect on poverty reduction that varies with the inequality of a society and with both the form and composition of growth. For example, the more unequal is income distribution underlined by the prevailing institutional environment, the weaker will be the impact of growth in pulling the poor above a poverty line; similarly there is considerable evidence that in Asia, at least, rural income growth has a much greater poverty reduction impact than does urban income growth and that agricultural growth is more conducive to poverty reduction than is manufacturing growth, although how to bring about agricultural growth is a separate problem. In most economies, as a rule of thumb, even a modest growth rate such as a per capita income increase of 1 percent annually should be sufficient to lower poverty levels. Hence economic growth in general should be good for the poor and conversely economic recession normally hits the poor hardest of all.

If there is no trade-off between growth and equity then we have a “win-win” situation in which governments and donors can have both growth and poverty reduction at zero cost. Whether or not we are in a win-win situation is an interesting and unresolved question. Until recently the conventional wisdom was that inequality was a necessary evil for faster growth, but over the last few years this interpretation has been challenged by a number of empirical studies (e.g., the World

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Development Report 2000/2001 on poverty), which appear to show that high inequality may be bad for growth. This raises the possibility of a virtuous circle, whereby for example interventions to improve the health and education of the poor raise their productivity and contribute to higher growth, which in turn finances more interventions. While this hopeful prospect no doubt lies behind the thinking of many on the pro-poor growth issue, it has not yet been fully demonstrated as a stylized fact of economic development and controversies remain. It appears that pro-poor growth or broad-based growth has been mainly discussed in a macroeconomic and political economy context with a rather ambiguous timeframe and most likely institutional setup being an endogenous variable in such a framework. The challenge for aid agencies is how to put such an unsettled concept into practice in the context of individual interventions, whose economy-wide impacts on distribution may be either marginal to the entire economy or very difficult to isolate from the impacts of domestic policies and larger forces of private sector investments.

Considerable effort has gone into thinking through the role of international agencies in the new policy environment. Since private sector-led development has been accepted by governments and agencies alike, the role of development finance has had to be rethought. ADB and other aid agencies now give much more attention than in the past to policy-based interventions that aim to influence the policy and institutional environment in an economy. For some countries (e.g., transitional economies), market oriented reform and continuous technical assistance for institutional strengthening may be the prerequisite for any sensible poverty-reducing projects. One obvious factor in selecting the assistance modality may be ADB's leverage in influencing the country's institutional landscape. While project finance continues in this new environment, it is recognized that there should be additionality arising from the projects that receive funding. If ADB operates in an economy with a dynamic private sector, then for such incremental effects to operate, ADB support must go to projects that either would not be done without its funding or would be done in a socially less desirable way. The two key examples are projects with substantial externalities (benefits that the private sector could not capture) and those with substantial poverty effects (which would rarely be financially profitable since by definition the poor have little effective demand). Where the private sector is weak the case for a catalytic role is, of course, stronger and poorly functioning capital markets, lack of information, and country risk can all be used to justify a wider range of ADB

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interventions. In such an environment, projects with positive growth effects will almost certainly have a significant impact in reducing poverty. On the other hand, in areas which have not benefited from positive growth effects, more targeted projects may be more effective in poverty reduction.

ADB recognizes that “it is often difficult in the case of individual countries to decide how much emphasis to place on poverty interventions and how much on more growth-oriented investments... In each country, the mix and nature of projects will be shaped by the poverty analysis (ADB, October 1999, p.14).” Nonetheless, with the new overarching goal of poverty reduction, economic analysis should be able to help in demonstrating the contribution of individual projects to poverty reduction. For example, growth oriented projects may have to demonstrate to the extent possible their channels and magnitude of poverty impact, or at the minimum, their pro-poor institutional and policy context. Poverty targeted projects may have to demonstrate that their impacts will in fact benefit the poor disproportionately relative to the non-poor.

#### **B. Project Appraisal Techniques and Poverty**

Although economic tools for project appraisal for developing countries have been well established and widely applied since the early 1970s, the methodology is based on comparative static analysis. Hence despite the obvious theoretical superiority of including dynamic factors and linkages of a general equilibrium nature, the techniques used for shadow or economic pricing are clearly based on partial equilibrium. Moreover, in practice in the work of international financing agencies, project selection criteria have been limited to the use of an efficiency test without taking account of distributional effects. The only notable exception of the systematic use of an operational extension of traditional project analysis to the distributional area is the work of the Inter-American Development Bank (IDB) that made a significant headway in applying distribution analysis in its lending operation in the 1980s.

It is obvious that richer information on distributive aspects can be very helpful in making sensible decision as to project alternatives and designs. Data and information collection with sufficient mind put to distributional effects up front in project preparation can usefully guide the appropriate project design to ensure envisaged benefits will actually reach the intended beneficiaries. Especially since ADB adopted the Poverty Reduction Strategy (ADB, Oct 1999) and poverty reduction became the overarching operational goal, it will be necessary to go beyond the

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isolated supplements such as farm income analysis and employment forecast for stronger justification for project selection and design. More effort is warranted toward integrating quantitative distribution and poverty impact analysis in project economic analysis, although not to the extent of applying distributional weights systematically in cost-benefit aggregation.

Project sustainability is strongly affected by who benefits by how much (in economic terms), relative to who pays by how much (in financial terms). One of the advantages of integrating distribution analysis is to be able to bring the financial and economic analysis together and assess the consequences of different financial arrangements on the net economic benefits of different stakeholders. Distribution analysis can show the extent to which public pricing policy affects the share of the private and public sectors in the net benefits of a service project. It can test the extent to which different designs of tariff structure in public utility projects direct benefits to particular income groups. Information resulting from these exercises can better inform the choice of policy alternatives and will be very useful in policy dialogue between donor agencies and developing country governments.

An additional advantage of distribution analysis as an appraisal tool is that it assures that the economic and financial analyses are done in a consistent manner: the differences between financial and economic values arising from a project will be equal to a series of distributional impacts that must be identified and quantified. Therefore the extent of incompleteness in the project economic analysis will be reduced. A further additional advantage of distribution analysis as a post-evaluation tool (although not the coverage of this paper) would be that it will force the evaluator to ask hard questions, for example, about why certain projects were carried out despite the ex post negative financial and/or economic values. Distribution analysis can illuminate lessons as to which stakeholders' net gain (vested interest) may have undermined the other stakeholders' net loss by how much in the process of decision making. Such quantitative information could serve as an evidence of a need for institutional and political reforms.

The Economic Analysis Guidelines of ADB (1997) include appendixes that illustrate how to go about distribution and poverty impact analyses. Although these do not provide detailed hands-on procedures, the judgement on their approach is reasonable and provides a good guide. An important practical question is how far we should pursue these analyses within often limited resources and

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data. The objectives of this paper are: (i) to provide background on the difficulties in aggregating benefits and costs accruing to different individuals; (ii) to review the practice, so far, of distribution and poverty impact analyses in ADB and elsewhere; and (iii) to discuss outstanding conceptual and practical issues that remain to be tackled. It is hoped that the paper will stimulate thoughts and discussions among ADB staff and developing member country (DMC) officials on how far and under what circumstances distributional issues should be integrated into project economic analysis to better inform decision makers for ADB projects.

## II. ON THE USE OF DISTRIBUTIONAL WEIGHTS

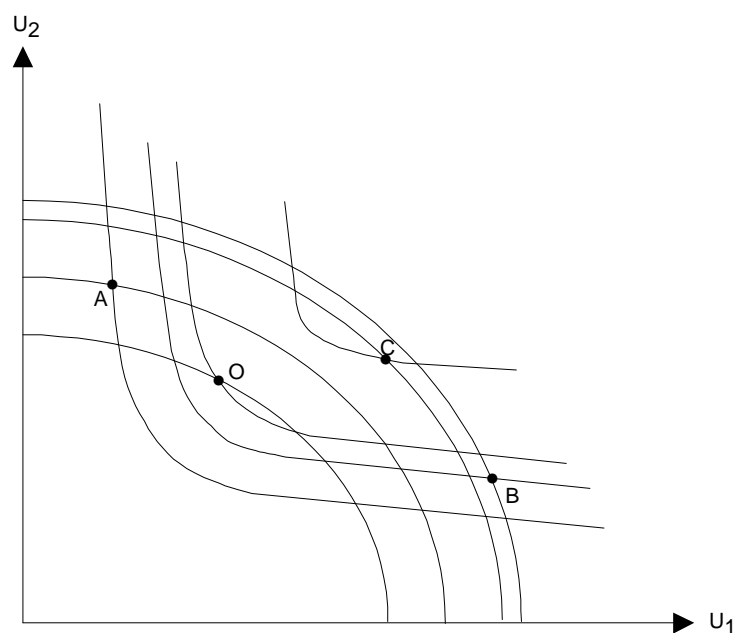
The purpose of benefit-cost analysis applied to project appraisal, or to any policy intervention for that matter, lies in its derivation of a single scalar, such as net present value (NPV) and internal rate of return (IRR), which captures the economic value of the project to the economy as a whole. Therefore, the analysis cannot escape the issue of how benefits (or costs) accruing to some groups compare with those accruing to others. There can be many ways of weighting benefits and costs accruing to different groups or individuals in deriving the net present value of the project. However, the traditional efficiency-based approach adds up non-weighted costs and benefits from projects regardless of who receives them, which implicitly uses a weight of 1.0 for all project participants. This treatment separates out an efficiency test for project selection putting aside income distributional effects of the project. (Some technical points in welfare economics are discussed in Appendix 1.)

There are some practical problems with designing and using distributional weights. They can be summarized as follows. First, as implied by Arrow's (1963) impossibility theorem, the assignment of distributional weights cannot escape subjective judgement by whoever assigns them. Project selection would become sensitive to the way distributional weights are specified. The weighting formula may easily become non-transparent especially when its basis moves from a simple income level to a composite of quality of life. The usefulness of benefit-cost analysis lies in its facility of decentralized decision making but the rationale and procedure must be determined at the central planning level. Therefore, whatever weighting schemes determined at the center must be transmitted to and well understood at practitioner level. It is hard to imagine this can be done without significant transaction costs. Moreover, public projects are often politically charged and distributional

weighting schemes seem bound to be abused. There is a risk that analysts representing particular vested interests may manipulate the weighting procedure in trying to justify their projects. Therefore, equal weighting seems to be the simplest and easiest to apply.

Second, within a usual static general equilibrium framework, some literature argues that implicit transfers through the use of distributional weights necessarily involve efficiency trade-off. For example, Harberger (1978) argues that when an inefficient project is accepted, the society ends up paying in terms of efficiency for each incremental distributional benefit it receives. Along this line of argument, we could think of a case in which a systematic use of distributional weights could lead to a lower level of social welfare in the long run. Figure 1 illustrates this potential case (adopted from Hatta, 1991).

Figure 1. **Efficiency and Social Welfare Criteria**



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Suppose the initial equilibrium is at point O. Consider two projects which move the economy to points A and B, respectively. Since efficiency improvement is represented by an outward movement in the utility frontier (utility frontier is derived from a Pareto efficient contract curve between consumer 1 and consumer 2), both projects pass the efficiency test. As the gains and losses associated with the two projects could potentially be reallocated such that points A and B move along their respective utility frontiers to the northeast of point O, they are both potentially Pareto improving. If both projects are implemented sequentially, the result would be equivalent to moving the economy to, say, point C, achieving a higher level of social welfare. However, if the distribution weights are such that the corresponding social indifference curves are as depicted (convex to the origin) in the figure, neither project would be accepted because both projects decrease the value of the social welfare. As a result, the society could fail to achieve social welfare improvement in the long run.

Finally, there is an argument that benefit-cost analysis with the traditional equal weighting need not be a final test of project selection. As long as it provides a consistent information based on efficiency criterion, it can function as a screening device to check against inefficient projects. Ranking alternative projects (or project designs) first according to efficiency improvement would provide useful information for decision makers, because they can know the extent to which they might choose to apply distributional consideration at the expense of efficiency. Any such “hybrid” procedure, or social choice procedure, should be made open and transparent.

Given the above line of argument, the final point on social choice brings us back to the initial question of how distributional considerations should be applied to project selection. Sen (1999) argues that Arrow’s axiomatic approach confines social choice procedures to rules that are essentially of the voting type and that we must go beyond the class of voting rules to be able to address distributional issues. Based on his extensive work in this area, Sen suggests that rather limited levels of partial interpersonal comparability will be adequate for breaking the exact impossibility. He suggests that apparently negative results of the impossibility theorem can be seen to be helpful in the development of an adequate framework for social choice, since derivation of a rigorous social choice procedure must lie close to an impossibility. Although pursuing such procedure is important in public choice theory, it would be beyond the scope of practical benefit-cost

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analysis. As a matter of practical application to project analysis, the ADB Guidelines' (1997) recommendation is a reasonable one: simply a statement of the distribution of project effects should be laid out, without applying any premium to incomes that are saved or to incomes accruing to particular income groups (p.174).

Integration of distributional weights in benefit-cost analysis has been discussed in the literature and its implementation in practice was once advocated. The seminal work by Little and Mirrlees (1974) spared one chapter to discuss different weights that may be applied between different income groups, between consumption and investment benefits, and between benefits accruing to the public and private sectors. Squire and Van der Tak (1975) refined these aspects and developed formulae to derive the weights. Ray (1986) advocated a systematic use of the distributional weights in project analysis. However, in retrospect, these recommendations were overly ambitious in practice. It has been observed at the World Bank that in project work distributional weights were rarely (if ever) applied operationally.

The less demanding approach (than the use of distributional weights) described in the ADB Guidelines (1997) has yet to be applied widely. The rare exception is the power sector in which distribution analysis was applied as early as 1996 and poverty impact analysis has been carried out consistently for several countries including the People's Republic of China (PRC) since 1998. Increasing efforts are also being made in other sectors since the adoption of the Poverty Reduction Strategy. However, it is premature as of the time of writing to make a comprehensive assessment of actual cases of distribution and poverty analyses within ADB. In the following, our account of ADB practice centers around interpretation of the Guidelines and a discussion of some significant points of theory and practice that the Guidelines does not address.

### **III. ADB GUIDELINES INTERPRETED**

Appendix 25 of the ADB Guidelines (1997) sets out the standard approach to distribution analysis of projects following the methodology first developed in United Nations Industrial Development Organization (UNIDO, 1972) and modified in minor ways in UNIDO (1978). While nothing here is new or theoretically incorrect, it is important to stress that the approach of distribution analysis has largely been found in research works (e.g., UNIDO 1980, Adhikari 1986, da Silva Netto 1994) as opposed to operational applications in the work of international or national development agencies.

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The major exception is the practice of the Inter-American Development Bank (IDB) in the 1980's where, in response to Board directives, a consistent use was made of distribution analysis in normal project analysis. Londero (1996a) reflects on lessons from this experience, while more details of how this approach was operationalized are in Powers (1989) and IDB (1979). We discuss experiences of the IDB and the World Bank later in the paper.

The approach set out in Appendix 25 requires that the net project benefits for the economy (economic net present value, or NPV) be allocated between different groups. The mechanism involved can be seen by drawing on the following identity:

$$NPV_{econ} = NPV_{finan} + (NPV_{econ} - NPV_{finan}) \quad (1)$$

where the subscripts econ and finan refer to economic and financial flows, respectively. The identity makes the point that the net income change created by a project is composed of the income flows identified in its financial analysis (such as taxes, profits, and interest payments), which go to governments, investors, and lenders plus the income flows created by divergences between economic and financial prices. Whenever a cost item has a higher economic than financial value, someone must lose an income greater than that captured by the price of the item in the financial analysis. Similarly, whenever an output has an economic value greater than the price at which it is sold, the benefit to the economy from the output exceeds its financial price and there is an income gain not captured in the financial analysis. Hence application of distribution analysis requires identifying, first, winners and losers from the financial transactions of the project and, second, winners and losers from the divergences between economic and financial values (sometimes termed either externalities or distortions affecting a project).

We can think of some simple examples for the allocation of the difference between financial and economic values.

- (i) Subsidies to project inputs are a net gain to input suppliers and a net loss to government (the rest of the economy).
- (ii) Employment of surplus labor in the project area is a net gain to the workers and a net loss to the project owner by the difference between the actual payroll and its economic value measured by the shadow wage rate.

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- (iii) For a project that increases the supply of, say, drinking water at a lower cost than the existing suppliers, the difference between the financial and economic value of the additional drinking water will be a net gain in consumer surplus and a net loss in producer surplus.

Explaining the problem in this way should make it clear that contrary to what many project analysts appear to think, distribution analysis requires no additional information beyond that required for a good conventional financial and economic appraisal, although imperfect practice due to resource constraint often means that additional resources will be required to do what is considered a good financial and economic analysis. NPV<sub>finan</sub> is simply the result from a financial appraisal and its derivation will imply the identification of income flows to various groups. NPV<sub>econ</sub> is the outcome of an economic appraisal. However, if appraisal is done crudely, (for example, NPV<sub>finan</sub> is before profits tax or financing arrangements are not included), or NPV<sub>econ</sub> only contains one single economic price, such as a shadow exchange rate factor (SERF), then the distribution information that can be obtained will be only crude. In other words, distribution analysis can be no more sophisticated than the original financial and economic calculations on a project. Detailed distribution analysis requires detailed financial and economic calculations.

ADB practice in financial appraisals differs slightly from that required for best-practice distribution analysis. This is because the normal financial analysis in project proposals, such as reports and recommendations of the President (RRPs), is based on a calculation of financial inflows (revenue) and outflows (investment, operating cost, profits tax). Conceptually this is a net-of-tax return to total capital. As indicated above this is short of what is strictly required since distribution analysis needs to know the return to owners or investors, who may get more or less than the net-of-tax return to total capital. This requires that, if it is known, the financing plan of the project be incorporated in the analysis. A difference can arise for two reasons; first, where the interest rate on the loan differs from the discount rate used in the economic calculations. Where the interest rate is below the discount rate the investors receive subsidized finance and there will be an income transfer between lenders (or those who would otherwise have received the subsidy) and project owners. The former will lose from the transaction and the latter will gain, so that the gain to investors will exceed the return to total capital by the loss suffered by lenders. A second area of difference can arise from

profits tax calculations. Normally, in most countries' tax regimes, interest payments are allowed to have deductions against tax. If interest payments are not incorporated in the financial analysis, the true tax bill will be lower than that calculated without interest deductions. This second effect will mean that the return to investors is understated in conventional ADB appraisals, while the first effect, where a loan subsidy is involved, will also have the same effect. Table 1 gives a simple illustrative comparison of current and desirable practice (in relation to distribution analysis). The overall return to capital is the same but its distribution is different in the two examples.

Table 1. **Comparison of Financial Analysis**

	Current Practice	PVa	Desirable Practice	PVa
Financial Inflow	Revenue	100	Revenue Loan	100 40
Financial Outflow	Investment Operating cost Profits tax	60 10 12	Investment Operating cost Loan principal Loan interest b Profits tax c	60 10 30 6 10
NPV1 (Return to total capital) (Gain to government)		30 12		
NPV1 (Net of tax return to total capital)		18		
NPV2 (Return to total capital)				30
NPV2 (Net of tax return to equity) (Gain to government) (Gain to lenders)				24 10 -4

Notes: a PV is present values.

b The loan interest rate is taken to be below the discount rate so that total repayments are 36 whilst the loan

is 40.

c Tax payments are lower due to deduction of interest from income liable for profits tax.

The first step for distribution analysis is the categorizations of beneficiaries. Careful disaggregation of beneficiaries would significantly improve project quality in terms of identifying and quantifying the differential project impact accruing to different stakeholders. Some indicative patterns of disaggregation are as follows.

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- (i) For a general case: disaggregation can be among owners of project operating entity, workers in the project, consumers of project outputs, input suppliers, lenders to the project, and government (representing the rest of the economy).
  - (ii) For poverty or gender: disaggregation can be by income level or by gender. Those who benefit or who control the additional financial resources for the project may not be those who contribute most of the extra effort (such as input in kind). This may be true for social sector projects in rural areas.
  - (iii) For nationals/foreigners: Strictly for economic analysis, only net benefits to nationals will be relevant, but some of these can arise from transfers from foreigners involved with a project. The use of foreign financing, either equity or loans, results in an initial inflow of capital into the host country, but an outflow in later years to service foreign debt and interest payments and the repatriation of foreign equity, capital gains, and earnings. Net foreign capital inflow to the host economy can be calculated from these two flows. Also, government policies can be analyzed in terms of national/foreign benefit/cost accrual. For example, tariffs on project outputs to attract foreign direct investment are a source of profits to the foreign investor but a cost to the host economy. Similarly, subsidies to project inputs are a source of profits to the foreign suppliers but a cost to the host economy.
  - (iv) For subregional projects: disaggregation should be by participating countries (e.g., Adhikari and Weiss, 1999).

The second step for distribution analysis is to account for the distribution of the economic benefits and costs over and above financial benefits and costs. This would entail a sequence of technical steps, which can be summarized as follows.

- (i) Identify sources and amount of distortions/externalities, defined as the difference between financial and economic values, of project inputs and outputs. To enable meaningful comparison of financial and economic flows, domestic price numeraire should be used in economic pricing.

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- (ii) Estimate the net impact of the distortions/externalities in each market as the real net economic values of resource flows less the real net financial values of resource flows (NEV-NFV).
  - (iii) Estimate the values of the various distortions/externalities on a period-by-period basis for the entire project life. Examination of the project's financial profile on a period-by-period basis will give the analyst an indication of the project's financial riskiness and sustainability.
  - (iv) Calculate the present value of the difference of economic from financial values using an economic discount rate of 12 percent, yielding economic NPV (ENPV) minus financial NPV (FNPV).
  - (v) Allocate this ENPV-FNPV across the various stakeholders of the project and summarize the distribution of net benefits in a table.

As distribution analysis requires flows in present values, the calculations are simpler if divergences between economic and financial values are constant over a project's life (i.e. the assumption of constant conversion factors). However, changing conversion factors can be handled readily by doing annual calculations on the items concerned and discounting values for each individual year to the present.

Virtually all expositions of distribution analysis work in domestic price units (as does the Guidelines). The reason for this can be seen by referring back to equation (1). Here the income flows from financial and economic calculations are compared directly, which requires that both be in the same price units. Since financial analysis is conventionally in domestic prices (that is prices actually paid and received) consistency requires economic calculations at the domestic price level. This is a point of presentation, not theory, however, since it is equally correct for both financial and economic NPV to be expressed in world prices units. This requires direct use of world prices for economic NPV and a step of converting financial figures into units of world prices. An illustration of this procedure is in Curry and Weiss (2000: 285-289). In normal circumstances, however, it is simpler to do economic analysis at the domestic price level if distribution analysis is to be applied.

Poverty impact analysis, as presented in Appendix 26 of the Guidelines, can be considered as a natural extension of the distribution (or stakeholder) analysis. But it does require further data. If for

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example distribution analysis shows gains or losses to broad groups such as, consumers of project output and project workers, poverty impact analysis requires the extra step of estimating what proportion of the net economic benefits accruing to each group goes to those below a poverty line. For the purpose of this impact analysis it is probably necessary to think in terms of an income/expenditure-based definition of poverty. In principle it is possible for either a national poverty line or an international line (such as the widely cited \$1 per day per capita expenditure) to be applied. Using broader measures of deprivation, rather than an income definition of poverty, is not ruled out in principle, but would require a considerable amount of data on the characteristics of households affected.

A particular focus on net benefits going to the poor is pertinent to many ADB projects. For agricultural projects, for example, the benefits to producers might be broken down among farmers with different income levels. For road sector projects, the benefits to different final users might be broken down among users with different income levels. Also a part of the road benefits are in some cases appropriated through land ownership. For those projects in which financial benefits cannot be calculated, it is still desirable to obtain information on the income level of different beneficiaries. Then, the proportion of net benefits in physical terms (service units) going to the poor and the non-poor provides a rough guide to poverty impact. In poverty impact analysis, for each category of stakeholders selected in the distribution analysis, the proportion of the net benefits going to the poor need to be estimated. This must be done for the entire economy, not just the district or province in which the project is located. The portion of the net benefits to the project workers going to the poor can be based on some broad assumption on who will be employed in the project. The portion of the benefits to the government (the rest of the economy) going to the poor can be estimated on the basis of the existing budgetary policy of the government, although as we note below there are serious problems in dealing with government net benefit.

Assessment of project beneficiaries in poverty impact analysis will require more data than is normally collected for ADB appraisals. However, arguably surveys of this type will be needed for accurate demand studies in any case. Hence if the analysts are required to explore marketing and willingness-to-pay issues then their work can be re-oriented to provide poverty impact data. Further, this type of additional information is very similar to data required if the good practice in social

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assessment, set out in the Social Handbook (ADB 1994), is to be followed. For example, good practice in social analysis of road projects requires that appraisals (ADB 1994:77)

- (i) identify sub-groups of expected road users;
- (ii) prepare a socio-economic profile of these users with data on income, livelihood, education etc.;
- (iii) compare their costs with and without the project; and
- (iv) determine their willingness to pay.

#### **IV. SOME CONCEPTUAL AND OPERATIONAL DIFFICULTIES WITH DISTRIBUTION AND POVERTY IMPACT ANALYSIS**

The procedure of distribution and poverty impact analyses summarized above is not without theoretical and operational difficulties. The main points include the following.

- (i) The problems in specifying benefits for high priority basic need goods supplied to the poor, possibly without charge;
- (ii) The possibility that different project participants will have different discount rates and hence private perceptions of benefits and costs will differ between groups and will also differ from social perceptions;
- (iii) The difficulty of specifying indirect income effects in the absence of a rigorous economic appraisal, which is especially problematic for poverty impact analysis;
- (iv) Pitfalls in operationalizing poverty impact indicators;
- (v) Incorporation of risk of failure in poverty impact analysis ;
- (vi) The difficulty of identifying the project counterfactual; that is, what the effect on the poor would be in the without-project scenario; and
- (vii) The difficulty of projecting dynamic effects.

##### **A. Externalities Beyond Willingness-To-Pay**

Distribution analysis is clearly directly relevant for projects targeted to serve poor communities; typical examples would be primary health care, water supply or urban re-development projects. Even if such services are provided free of charge, consumer benefits associated with one unit of service are its marginal welfare gain i.e. what the consumer would have been willing to pay. This is an economic gain and poverty impact requires an assessment of the proportion of this flow going to the

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poor. The operational difficulty is that it requires either evidence on costs of alternative sources of supply that consumers might use (such as charges from private doctors, water vendors or landlords) or direct willingness-to-pay surveys. A theoretical difficulty is that if consumers do pay for the service at a price equal to their estimated willingness to pay, they will experience no net gain. A poverty-focused project that charges consumers, therefore, is taken to benefit them only if a consumer willingness-to-pay is involved. The problem arises because in conventional welfare economics all goods can be expressed as worth an income equivalent; i.e. the additional welfare to an individual expressed in money-metric units. However the usual purpose of poverty-focussed projects is to make available goods and services that the poor could not otherwise get (e.g., basic needs such as good health, clean water, and safe and sanitary dwellings); i.e. they are meant to serve a merit want objective. Since willingness-to-pay is directly related to income and ability to pay, the small amount the poor might be willing to pay for clean water need not be an adequate reflection of planners' (or society's) view of welfare. This brings out the issue of how to weigh the benefits of poverty-focused projects going to the poor and non-poor even when we avoid the use of explicit distributional weights in shadow pricing.

It can be argued that market failure exists in the case of merit goods (such as basic need items), which society (or planner) values above what the poor are willing to pay for them and where there is lack of information, so the poor may not express the willingness-to-pay that is consistent with the full consequences of their lack of access to certain goods and services. Hence, pursuing an approach based on willingness-to-pay for basic need goods and services can understate their (i.e. planner's) social value and hence, understate how far the poor benefit from poverty-focussed projects. Benefit quantification involving externalities is also difficult in the traditional efficiency-focused analysis, such as in primary health care and waste management projects. In many cases the only sensible solution to this problem is likely to be a form of headcount approach identifying number of the poor receiving particular goods and services.

#### **B. Choice of Discount Rate**

Central to the approach of distribution analysis is the allocation of project NPVs between different groups. This involves discounting back to the present. Virtually all published examples of distribution analysis do this at one single discount rate (typically either 10 or 12 percent)

approximating the economic cost of capital. However, there is ample evidence that private investors perceive time in a different way from public sector planners, as private investors' discount rates tend to be considerably higher in the 15-20 percent range (no doubt due to differing perceptions of risk). This means that from the private investors' perspective, future income is less valuable than from the social point of view. A distributional consideration illuminates a divergence of discount rates perceived by different stakeholders and may present a practical problem in mobilizing resources for project investment. (Please note that the paper does not get into the theoretical issue of how a society's social time preference and marginal return on investment should be reconciled but simply take the 12-percent opportunity cost of public funds as a practical simplification.) The problem can be illustrated with simple numerical example, which for simplicity assumes no loan finance. Consider the case of a project with a one-year life and the following data.

Table 2. **Illustrative Distribution Calculation**

Financial Analysis	Year 0	Year 1	PV at 12%	PV at 20%
1. Investment cost	80.00	0.00	80.00	80.00
2. Labor		24.00	21.43	20.00
3. Revenue		150.00	133.92	125.00
4. Operating Profit 3-(1+2)		126.00	112.50	105.00
5. Profits tax at 20% (4*0.2)		25.20	22.50	21.00
Financial Benefit 4 - (1+5)	-80.00	100.80	10.00	4.00

At a 12 percent discount rate, the project has a financial NPV of 10, but at a 20 percent discount rate (reflecting an investor's own perception), it has one of only 4. In other words if 12 percent is taken as the "true" opportunity cost figure, actual real gains to the private investor are more than perceived gains, either because of lack of information, risk aversion, or simply irrationality.

An economic dimension can be added to this example by using a labor conversion factor of 0.5. Now following equation (1) and the procedures of Appendix 25, a conventional distribution analysis at 12 percent discount rate will show

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Gains to private sector	10.00 (Financial NPV)
Gains to government	22.50 (PV of profits tax)
Gains to labor	10.72 (50% of PV of labor cost)
<hr/>	
Economic NPV	43.22 (sum of the above)

However, because 12 percent is the economic, not private, discount rate, this analysis must be inaccurate as far as the private investor's own perceptions are concerned. This is clearly a difficulty with the methodology, since investors will act on their own judgements not those of economic planners. If we use the participants' own perceptions to value income flows then in our example gains will be as follows.

Gains to private sector	4.00 (Financial NPV at 20%)
Gains to government	22.50 (PV of profits tax)
Gains to labor	10.72 (50% of PV of labor cost)
<hr/>	
Economic NPV	37.22

If the economy in question is assumed to be in the state of sub-optimal rate of investment, it can be argued that the policy conclusion to draw from here is that governments should introduce measures to lower private discount rates (for example by reforming financial institutions or improving information flows), although this is easier said than done.

### C. Tracing Indirect Project Effects

It is well known that indirect project effects can have distribution consequences that may be at least as significant as direct effects. For example, direct employment effects of a project may be lower than the employment generated indirectly in supplier activities. A full distribution analysis should aim to capture all major effects. The most rigorous way to do this is to apply semi-input-output techniques. Where a project is very large, a special semi-input-output table can be constructed around the project itself, so that the input suppliers to the project enter as columns of the table. Solution of the model decomposes each project input into a number of primary factors such as labor, capital, surplus profits, taxes, and foreign exchange. Valuation of each primary factor (such as a labor conversion factor of 0.5) allows estimation of the income gain involved. In the absence of this very detailed project-specific approach, one can use a national semi-input-output table to decompose project inputs. For example, Table 2 shows three sectors—water, power, and

transport—from a recent input-output table for Jamaica (Weiss, 1999). If one makes the sometimes strong assumption that the sector covered in the national table exactly reflects the supply conditions for the input supplied to the project, then the national decomposition can be used for project calculations. The data in Table 2 suggest that for every unit of expenditure on, say, power, its supply cost will be composed directly and indirectly via the national input output relations of 0.16 units of labor, 0.33 units of foreign exchange, 0.50 units of capital, and 0.01 units of transfers. This approach allows the incorporation of indirect income effects, principally wage, profit and tax flows, in project calculations. The actual income gain to, say, workers or investors will depend upon the relationship between economic and financial values; in other words, on the difference between actual and economic wages and between actual and normal profits (returns from alternative investments). For example, if the labor conversion factor is 0.5, for every unit of expenditure on power, there will be a gain to labor of 0.0775 units. Similarly if the actual rate of return on capital is 24 percent and the normal or opportunity cost rate of return is 12percent, investors will gain 0.25 for every one unit expenditure on power.

Table 3. **Total Factor Inputs into Non-Traded Activities, Jamaica**

	Power	Water	Construction	Transport	Distribution
Labor	0.155	0.362	0.383	0.212	0.173
Foreign Exchange	0.333	0.252	0.288	0.494	0.169
Capital	0.500	0.357	0.259	0.236	0.634
Transfers	0.012	0.029	0.070	0.058	0.024
Total	1.000	1.000	1.000	1.000	1.000

Source: Weiss (1999).

However, such semi-input-output data are rarely available for DMCs (although they could be if special studies were commissioned). In many cases (and in the illustration in Appendix 26 of the ADB Guidelines), a common short-cut approach is to apply a single standard conversion factor (SCF), or its inverse, the shadow exchange rate factor (SERF), to all nontraded components (and in some cases incorrectly all local costs). This means that if the SCF is 0.8 and an input such as power costs 100, only 80 of this will be an economic cost and 20 will be an income gain for someone outside the project. While the coefficients from a semi-input-output table can be used to identify where this 20 goes, in their absence some approximation will have to be adopted. One sometimes

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used is that where any effect cannot be allocated to a particular group, it is assumed to go to the government or the rest of the economy (as the recipient of taxes and the payer of subsidies). Again, this is used in the example in Appendix 26 of the ADB Guidelines. However, in the context of poverty impact analysis, this assumption may not be adequate, since there is still the question of how additional government income affects the poor.

Crucial to the poverty impact analysis is the appropriate distribution assumption on the proportion of the net benefits accruing to each stakeholder category that eventually goes to the poor. The approach set out in the ADB Guidelines requires decomposing net benefits to all groups affected by a project and dividing these into net benefits for the poor and non-poor. Conceptually, this is relatively straightforward (if sometimes empirically difficult) for private sector groups. It is both conceptually and empirically problematic for the government, however. This is because the government can be seen as an intermediary institution creating income for others via its expenditure activity and taking it from them through borrowing and the tax network. Hence, if government income rises as a result of a project, the issue for poverty impact analysis is how this income change for the government affects the poor. In principle, there are two possibilities or a combination of these. One is that extra government income leads to a fall in taxes or borrowing (or a rise where government income falls). In the first case, the poor will benefit on the basis of the incidence of marginal taxation. If 20 cents of an extra dollar raised in taxation would be paid by the poor, then in principle, if taxes fall, the poor will gain 20% of the rise in government income (and conversely where income falls). In the second case, if the government borrows less, again there will be a fall in taxation as lower future repayments are involved. The alternative possibility is that higher government income leads to higher government expenditure (or lower expenditure for a fall in income). Here, the impact on the poor will depend on the proportion of marginal government expenditure that goes as a benefit to the poor. Empirically, this is very difficult to assess. One approach is to assume that the impact on the poor from marginal government expenditure is zero (on the grounds that they are ignored by non-poverty focussed projects). Another is to use the share of the poor in national income as the proportion (this can vary significantly depending on where the poverty line is drawn). A third is to use a simple rule of thumb like 50 percent (this is what is done in the illustration in Appendix 26). None of

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these approaches are correct in the abstract, but at a minimum, the problem should be recognized explicitly and the consequences of alternative assumptions need to be explained.

**D. Pitfalls in Operationalizing Poverty Impact Indicators**

Provided that the above problems are overcome or dealt with through various simplifying assumptions, some caution must be applied in using various types of poverty impact indicators including the poverty impact ratio (PIR) that is set out in Appendix 26 of the ADB Guidelines. The illustration in the Guidelines shows a case of water supply project in which a uniform increase in the water tariff rates, as opposed to the base case, resulted in a higher PIR but with lower absolute net benefits going to the poor, due to the depressed demand. Only looking at the PIR as a decision making guide will be misleading in this case. The ultimate decision should be based on the total net economic benefits and their distribution profile, with PIR used as a supplementary index. A sensible solution to the above problem would be to try a differentiated tariff structure and see how the PIR and the absolute net benefits going to the poor can both be raised. The experience of the IDB (described below) echoes the need for caution with the use of poverty impact indicators.

The same Guidelines illustration also brings out the point that pricing policy for activities that supply the poor and the poverty impact of these activities are directly related. There is a serious practical issue to consider in setting charges for water, for example, or in designing user fees for health and education activities. Higher charges will help cover costs and thus contribute towards financial sustainability. However, they will also have a negative impact on use of the services or goods by the poor. Ultimately, projects that serve the poor have to be financed in some way. If they are self-financing via full cost-recovery charges, the direct cost to the poor will be higher, while service provision can be guaranteed. If they are financed by central or local government transfers, however, the direct cost to the poor will be zero, but service provision may be unreliable if the availability of funds is variable. Alternatively, if such schemes are funded by central government deficit financing, there may be macroeconomic costs, of which the poor bear a significant proportion. The implication of this is that whatever poverty intervention projects are envisaged must have a funding provision identified at the outset and the projects should be both designed and funded in a way that minimizes the total costs to the poor (defined in both long and short-run senses).

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### **E. Incorporating Risk of Failure in Poverty Impact Analysis**

The dimension of risk in project analysis is of significance in discussions of poverty since the poor are the most vulnerable to unexpected unfavorable outcomes. It is often argued that from a national point of view risks can be pooled across a range of projects and that hence the probability of failure should not be an issue in decision making. Hence, if the expected IRR is above 12 percent, the probability that it may be below 12 percent is irrelevant. This argument is one reason why the ADB Guidelines (1997) do not cover risk of project failure. However, where one is concerned with particular groups—like the poor—the risk-pooling case is less convincing since governments and aid agencies should be concerned with reducing their exposure to risk, because of their greater vulnerability. A reduction in vulnerability is a central element in a poverty reduction program and a sharing of risk across a wide portfolio of projects may still leave the poor excessively exposed. Hence, for important poverty focused projects for which monetary estimates of costs and benefits to the poor are feasible, it is desirable that both the probability of overall project failure and the probability of a negative outcome for the poor be assessed. The overall result can be incorporated in the project poverty statement. If a project appears high risk for the poor then the implication is that it should either be redesigned to reduce this risk, or if this is not possible, it should be rejected. What is high risk is ambiguous, but as a rule of thumb, anything with more than a 25 percent risk of failure for the poor should certainly be looked at in detail to see if this potential for failure could be lowered. Once a distribution and poverty analysis has been carried out and the benefit and cost streams for different groups of project participants or for the poor and non-poor have been established then risk analysis techniques can be applied to the group benefit and cost flows. With such an analysis annual values for selected variables cease to be unique single values and vary systematically around the mean or expected value.

Risk analysis differs from sensitivity analysis in that it varies different project parameters simultaneously and allows for a probability distribution of possible outcomes for the parameters that are being varied. There is a wide menu of probability distributions to choose from and different parameters can be handled in different ways. For example, risk of variation in crop yields may be best handled using a normal distribution with the range of the distribution determined by the relation between the mean and the standard deviation (or the average distance from the mean). On the other

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hand, variations in some cost items may be best dealt with by a simple rectangular distribution, of say 10 percent plus or minus the best-guess value, and an equal chance of the actual figure lying within this range.

Different software packages are available for this calculation. Such software allows the analyst to select from a menu of alternative probability distributions for different variables. It proceeds by generating a set of random numbers, which will correspond to different values in the probability distributions. The project NPV and IRR calculations can then be carried out with each parameter varying at the same time. Although the analysis is potentially sophisticated, its accuracy will be critically dependent on the reasonableness of the selected probability distributions. The key point for applying this approach to poverty analysis is to be able to separate out benefit and cost streams that go exclusively to the poor from those to the non-poor. A numerical illustration is provided in Appendix 2. ADB Guidelines (1997) does not include a section on risk analysis, but explanations are found in introductory project texts (for example Curry and Weiss 2000 Chapter 9). The original theory was set out in Pouliquen (1970).

#### **F. Difficulty of Establishing Project Counterfactual**

Most fundamental difficulty associated with any project appraisal, even without integration of distribution analysis, is the establishment of project counterfactual. Adding the distributional dimension adds yet another complexity. Following the standard principles of project analysis, a project NPV is the net economic benefits generated in excess of that from an alternative project, whose IRR is specified by the discount rate. The same logic must apply in distribution analysis. Hence, implicit in the literature and the approach in Appendixes 25 and 26 is the assumption that the project counterfactual (i.e. the alternative to a particular project) is an NPV of zero at a 12 percent (or some other) discount rate. Again implicit is the assumption that all net benefits from the alternative project go to different groups in the same proportion as in the project under examination. That this is so can be seen using a simple numerical illustration.

Suppose from a distribution analysis of a project, economic NPV of 100 is estimated to be distributed as {Consumers 40, Workers 30, Government 30}. These figures are normally presented as the net gains from the project for the different groups on the grounds that the alternative to the project is an NPV of zero at the economic discount rate. However it is conceivable that distribution

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outcomes between this project and the marginal alternative project are quite different. For example, the project counterfactual of an NPV of zero may be distributed as {Consumers 10, Workers 0, Government -10} instead of {Consumers 0, Workers 0, Government 0}. If this is the case, the true net distribution impact of the project under appraisal is {Consumers 30, Workers 30, Government 40}. If the poor are only workers this qualification makes no difference but if they are part of the group of consumers, the original analysis may be misleading.

This will not be an issue if project alternatives can be compared, since the counterfactual is simply the other project or projects. However, it is virtually impossible to establish the distribution outcome associated with a marginal project in the abstract. Hence, for the analysis of a single stand-alone project, it is worth reminding ourselves that distribution calculations for a single project, as in Appendix 25, are based on an implicit assumption about the distribution of benefits from alternative investments, which need not always be accurate and which reflects our ignorance of the counterfactual. The problem of the marginal alternative project is particularly serious in trying to estimate a project's true poverty impact, since in principle we wish to know how an alternative marginal project (as opposed to the project under consideration) would have affected the poor. In an extreme case such as one in which a large electronic assembly firm relocates next to the influence area of an agricultural project, the project beneficiaries who choose to stay engaged in the project may well turn out to be worse off than the non-project unskilled labor who go to work with the electronics firm.

#### **G. Difficulty of Projecting Dynamic Effects**

Admittedly the current economic tools for project appraisal is based on comparative static analysis. This is by far the simplification of how the real economy could be modeled, perhaps for good reasons: transparency and workability in practice. Benefit-cost literature includes some extension of the analysis to dynamic models in which key parameters including shadow prices and discount rates need not be constant over time. The same theoretical argument would apply to the parameters specific to poverty impact analysis such as the proportion of project benefits accruing to the poor being assumed constant in the current guidelines. The only sobering point to be made here is that it seems to take a heroic effort to make dynamic models operational in the practice of project appraisal, while to some extent dynamic models are useful for policy level analysis as resources for

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involved modeling could be warranted at the policy level. Naturally, a workable extension to distribution analysis would best start from where the current practice is. For poverty impact analysis, some may argue that a distinction be made between the transient poor and chronically poor as the former would be more responsive to income-stabilization interventions while the latter would need more fundamental human capital enhancing interventions. It would be ideal to be able to predict how the assumed project beneficiaries under the poverty line may rise above the line or vice versa and to include only the benefits accruing to the periods in which they stay below the poverty line. However, it would be very difficult to make it operational due to the likely speculative nature of projecting the intricate dynamics of the poor's response to future prices and institutional changes. This issue would be best handled in the project monitoring and evaluation stage in a comprehensive set of performance indicators with different timeframe (short-run, medium-run, and long-run) assigned to different sets of indicators (input indicators, output indicators, economic indicators, and social indicators).

## V. IDB EXPERIENCE

Several agencies have produced handbooks or guidelines that set out a similar approach to the ADB Guidelines (1997): e.g., IDB (1979), ODA (1988), World Bank (1998), and European Commission (1997). However only the Inter-American Development Bank (IDB) has pursued this form of analysis on a systematic basis and then chiefly only during the 1980's. Powers (1989) and Londero (1996a) reflect on both the procedures and lessons from this experience.

To implement the directive of its Board that projects should have a measurable poverty impact, the IDB applied three alternative coefficients of income distribution (CID). (Note here "income" is used in a generic way and what it really represents is economic benefits in the context of project analysis). First, where project benefits could not be expressed in monetary terms, a headcount indicator was used.

$$\text{CID} = \frac{\text{number of low-income persons}}{\text{total number of beneficiaries}} \quad (2)$$

The potential for error in this approach, where some beneficiaries may receive unequal shares of benefits, was recognized and where benefits could be valued, a second indicator was considered.

$$\text{CID} = \frac{\text{value of net benefits to low-income persons}}{\text{economic NPV}} \quad (3)$$

This is equivalent to the PIR defined in the ADB Guidelines. However, as discussed above, the IDB encountered a serious problem in the treatment of government income. Their original handbook (IDB 1979) suggested a rule of thumb of 0.5 as the share of government income ultimately benefiting the poor. However, detailed studies to identify the distribution consequences of marginal public sector projects in a number of countries failed to produce convincing results (Powers 1989: 57-58). Hence, in response to this difficulty a third indicator was used.

$$\text{CID} = \frac{\text{value of net benefits to low-income persons}}{\text{economic NPV minus net government income}} \quad (4)$$

Expression (4) gives the share of benefits to the poor as a proportion of net private sector benefits. At least one of these indicators was systematically applied in project work with a view to establishing the overall poverty impact (CID) of IDB lending. The results reported in Powers (1989) show an aggregate CID of just below 50 percent in the 1980's with significant sector variations. It is noteworthy that it is the infrastructure sectors of energy and transportation that on average show the lowest CID indicators. It is not clear whether this is due to the fact that these sectors genuinely have the weakest poverty impact or whether it is simply more difficult to trace the full distribution effects in these sectors, because many of their initial beneficiaries are intermediate rather than final users.

Other than the operational issue of the poverty impact indicators, it is useful to draw from the IDB experience some implications for resources and data requirements if a poverty-focused distribution analysis is to be taken seriously. Londero (1996b: 261) rightly points out that for such analysis to be successful, it is important to take distributional aspects into account right from the start of project preparation, including identification of alternatives and collection of specific data. Subsequently, estimation of poverty and distributional effects must become an integral part of preparing financial flows by identifying the main effects by main beneficiaries classified according to the same criteria that are used in economic analysis. Relying on Londero (1996b), two dimensions to the distribution analysis, input/cost side and output/revenue side, will be discussed below. Much of the discussion is related to the difficulty of tracing indirect project effects discussed earlier.

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On the project input side, errors may arise from the unavailability of a set of conversion factors (to move from financial to economic values) as well as from the difficulty of quantification of the main externalities. When the analyst uses economic prices that are taken from elsewhere, it is difficult to go beyond efficiency-based economic analysis, since the desired disaggregation may not have been carried out initially. For example, in estimating the gains to labor, different conversion factors for different categories of workers, instead of a uniform shadow wage rate factor, will be needed. This will require additional information on alternative employment opportunities for different workers, so the difference between financial and economic values for labor in rural areas may be distributed between different households differentiated by income level. When input-output techniques are used in estimating distributional effects associated with domestically produced project inputs, additional work will be required in preparing the matrix of non-produced inputs and transfers required for this greater disaggregation.

If the stakeholders in the distribution analysis include lenders versus borrowers, the effects of financing come into the picture (as mentioned in Section III). The main difficulty in quantifying the amount of distributional effects in long-term financing is to express the loan repayment flow in real terms, where there is no adjustment clause for inflation. Doing so will inevitably involve a margin of error that is always present in any financial analysis. Distribution effects arising from project financing may be further complicated if multiple financial intermediaries are involved. The effects on the recipients' end may be relatively easy to identify (as recipients will consist of households or firms who are the ultimate borrowers in the project) but the effects on the suppliers' end may not be easy to identify and quantify, where a number of financiers are involved at different stages.

On the project output side, how to estimate the distributional effects depends on the nature of the output and on the procedure traditionally followed to estimate the relevant economic prices. For import-substituting outputs, the difference between financial and economic values will be distributed mainly between the project entity, consumers, competing importers, and government. For non-traded outputs, such as irrigation services, the difference will be distributed mainly between farmers, unskilled workers, co-operatives, financial intermediaries and government. Different implications of distribution analysis are applicable to different sectors. For agricultural and rural development projects, main individuals affected are typically farmers and the project benefits are based on

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comparing representative farm budgets in situations with and without the project. Such farm budgets might be prepared according to farm size and type of production technology used, which will form the basis of allocating the difference between financial and economic values of the project output. Here a difficulty may arise due to the lack of information on the marginal producers displaced by the additional supply from the project. Additional information requirements will depend on whether the project outputs are consumer or intermediate goods. For consumer goods, it is necessary to have data on expenditure on such goods according to income brackets, which might be obtained from household income and expenditure surveys. For intermediate goods, it will be necessary to identify and quantify the effects on other markets caused by the price changes, due to the project, and to allocate these effects to consumers of different income brackets. This will require a significant amount of additional information such as user industries' demand elasticities for the intermediate good in question.

For public utility projects such as electricity and potable water supply, benefits are quantified mainly through willingness to pay for additional consumption of a homogeneous good supplied by public or publicly-regulated monopolies. Here, the main additional data required will be demand projections by user type and income brackets. This is important because the supply policy and design based on this information determines access to the service. Demand projections for medium and high-income people can perhaps be made on the basis of population and income growth rates and estimates of the income elasticity of demand. However, demand projection for the poor will also depend on the connection policy determining investment in distribution networks, which may not be straightforward.

For road projects, benefits are quantified by saved costs in vehicle operation and travel time. Part of the savings in time and operating costs corresponds to pleasure trips while part corresponds to business trips. It may be difficult to classify these savings according to income brackets. Data are required that are specific to the project (route of the road) and such data may be costly to gather, particularly if this involves more than merely incorporating questions into an origin and destination survey. Unless additional resources are provided, a good practice social assessment, as described above, may be a difficult task for sectors like transport.

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All in all, the extent of additional data requirements in poverty analysis and the usefulness of its result depend on how well focused the project objectives and intended beneficiaries are and how much resources are available to do project-specific poverty impact analysis. If intended beneficiaries are clear from the beginning of project preparation, which may have to be preceded by good sector work, social surveys can be designed in a way that is compatible with existing complementary data and is most useful in, for example, processing data classified according to income levels. This is a useful reminder that for ADB projects, if a poverty-focus is to be operationalized systematically, there will need to be closer collaboration than previously between project analysts and those designing and implementing social impact surveys, so the latter can be developed to feed into a project's poverty impact analysis.

#### **VI. WORLD BANK EXPERIENCE**

As we have seen above, in the 1970's the World Bank experimented with the development of a sophisticated income weighting system that would allow the recalculation of project benefits and costs, and hence economic IRR and NPV, to allow for distribution impacts. However apart from some project studies of a research nature this weighting approach was never operationalized. One of the key authors of the original method gives three explanations for the neglect of this formal approach (Squire in Devarajan et al 1996): (i) subjectivity: staff were uncomfortable with basing appraisals on a weighting system that required subjective weights; (ii) practicality: there was a view that the distribution consequences of projects could not be established with accuracy; and (iii) efficiency: most fundamentally it was felt that there were other more efficient means of achieving distribution objectives than building these formally into project calculations.

In the late 1970's a second and separate literature was developed in the World Bank on benefit incidence analysis. This involved identifying the beneficiaries of broad categories of government expenditure—such as primary and secondary education—and disaggregating these by income class, such as quintile or decile. Normally detailed survey data was required for this exercise. The work was not linked directly with project appraisal procedures and a simple benefit assumption was used that benefits to the classes of recipient equaled the financial cost met by the government (rather than the theoretically more accurate measure of willingness to pay). An influential use of this approach was the study on Malaysia (Meerman, 1979). For a more recent statement of current

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efforts in this area see van der Walle (1998). However this work has largely been used for policy discussions on the distributive impact of different expenditure categories, such as primary, secondary or tertiary education or preventative versus curative health expenditure and does not appear to have been applied in a project context.

However, with the World Bank's continued focus on poverty reduction there has been a revival of interest in establishing the poverty impact of individual projects even if this no longer involves the application of distribution weights in project calculations. The new Handbook (World Bank 1999) discusses means of assessing the poverty impact of projects and programs. The basic approach involves identifying a sample of persons or households affected by a project and matching these with a similar comparator or control group not affected by the same project. A baseline survey must be conducted in the before-project situation and a similar follow-up is needed after implementation. The gain to the affected group due to the project or program is the difference in their income or in some alternative measure of welfare between the before and after situation minus the same difference calculated for the control group. Technically this is described as a "double-difference" method. An illustration of this approach for the type of project that ADB is involved with is the impact evaluation of a World Bank Rural Roads project in Vietnam (see World Bank 1999, annex 1.15). This involved a survey of 100 project and 100 non-project communes located in the provinces covered by the project. A baseline survey was carried out in 1997 and administered to 15 households in each commune. It was used to construct several commune-level indicators of welfare, including agricultural yields, income sources, employment opportunities, land use and distribution, availability of goods and services and asset wealth and distribution. The initial baseline survey is to be followed up in three after-project surveys at two-yearly intervals. The cost of this type of impact evaluation studies varies widely, from 0.2 to up to 3.6 percent of the total project, ranging from \$223,000 to \$878,000 as listed in the World Bank Handbook.

It should be clear from this discussion that the impact assessments envisaged are ex post rather than ex ante. They should hold lessons for future projects, but given diversity of experience it is not automatic that, for example, the impact of one road building and rehabilitation project in particular provinces of Vietnam will hold nationally. The advantage of ex post empirical study is the tangibility of the result, but the lengthy nature of some surveys make them closer to applied research

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studies than the type of expertise that is associated with ex ante feasibility studies. Its cost is also not insignificant. Nonetheless accumulation of empirical evidence on poverty impact for various interventions would benefit project preparation either as lessons learned or in some cases as secondary data to be used in other appraisals, with some project-specific adjustments.

#### **VII. PRACTICAL ISSUES IN POVERTY IMPACT ANALYSIS: DATA REQUIREMENT, PROJECT TYPOLOGY, AND DECISION CRITERIA**

This paper has summarized where we stand in the treatment of distributional issues in project economic analysis and what have been the standard methods of distribution and poverty impact analysis at ADB and elsewhere, and provided a review of conceptual and practical issues that remain to be tackled. It would be wise to keep the procedure of project economic analysis as transparent as possible with its role primarily serving as an efficiency test (NPV or economic internal rate of return [EIRR]). However, the efficiency test need not be the final decision of project selection, particularly where poverty impact is judged to be important. Distribution, and its extension to poverty impact, analysis can provide decision-makers with useful additional information, which can be considered as a check on the social sustainability and desirability of a project. Presenting distribution effects between the poor and non-poor measured by income levels is, though useful, only one additional piece of information on a project and needs to be supplemented by others of an economic, financial, environmental, and social nature.

Given the above qualification, where do we go from here in terms of economic project appraisal? The basic approach to distribution analysis described in the ADB Guidelines brings financial and economic analyses together and reduces room for incompleteness in the total analysis. More importantly, data and information collected with distribution effects in mind at an early stage in project preparation might usefully guide project design. For example, pricing and connection policies for water supply projects or feeder road design in expressway projects might be considered such that a certain portion of the poor beneficiaries rise above the poverty threshold or are ensured of access to the project-supplied services. In the same regard, such analysis at the beginning of project preparation might also illuminate potential areas of policy and institutional reform, helping to bring together policy- and project-based assistance.

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The practical question is how far we should pursue the poverty impact issue in economic analysis of projects. As ADB is now mandated to pursue poverty reduction throughout its operations, it is imperative to speed up its learning-by-doing especially for poverty impact analyses. ADB's Poverty Reduction Strategy Paper (October 1999) makes clear the need to assess all projects from a poverty perspective. Two groups of activities are identified—Poverty Interventions (of which Core Poverty Interventions is a subset), and Other Developmental Interventions. Assuming these can be related to types of project, the question then becomes how one handles such projects in economic calculations.

In applying the poverty impact analysis as presented in Appendix 26 of the Guidelines, there needs to be a defined poverty line that separates the poor and non-poor. In principle, the methodology could allow any level of poverty line or as many lines as the analyst wishes depending on the data and resources available. The dichotomy of below-or-above the poverty line is a matter of practical choice as is done in much of the poverty measurement practice in the more aggregate level. At conceptual level, it is possible to consider using more comprehensive measures of poverty such as poverty gap and Gini coefficient. It is well recognized that the simple dichotomy is an unsatisfactory measure of poverty situation given its multidimensionality. The disparity between urban and rural poverty is well known in some countries due to divergent quality-of-life baskets. However, it is also generally recognized that at a disaggregated level (such as project site), there is a statistical limitation in estimating even simple income level through one-time household survey. While this could be remedied by extending the existing census data to a disaggregated level, anything more than the uni-dimensional income data, such as inclusion of various social dimensions or the use of more sophisticated index such as poverty gap or Gini coefficient, would be very costly to estimate at project level. There needs to be a realistic compromise between informational usefulness of the appraisal result and the resources available for preparation of individual projects.

For the immediate purpose, the poverty impact analysis can primarily utilize the national poverty lines to be agreed between DMCs and ADB on an individual country basis, which will be available to identify who falls within the target group of the poor. The definition of the very poor (or core poor) is referred to as the target group for Core Poverty Interventions, but it should not be difficult to establish a working definition for this category. Once poverty lines have been clarified, the

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techniques of distribution and poverty impact analysis in the Guidelines can be applied to identify gainers and losers in monetary terms (or in physical terms where benefit monetization is not possible) and the proportions of these who are below the poverty line. This information will be in addition to normal EIRR (and NPV) estimates. Where at present, as in health and education activities, benefits are often not monetized, it is not suggested that this be attempted just for the purpose of poverty impact analysis. As noted above, for this type of project, a headcount approach based on number of poor beneficiaries would be a realistic recommendation probably supplemented by a form of cost effectiveness calculation.

The framework of analysis should be sufficiently flexible to deal with the range of projects which ADB finances. At one end of the range are projects in sectors such as power and irrigation, where economic analysis techniques are regularly applied in a rigorous way and where the use of distribution and poverty analysis may be a natural extension of current work. At the other end of the range are projects in health, social, and education sectors for which EIRRs are rarely, if ever, calculated. Such projects can be subject to cost-effectiveness analysis, which is increasingly being applied. The criteria for poverty-focused projects should be able to accommodate projects for which we need not apply a monetary estimation of benefits. Hence, beneficiaries may be in terms of numbers of poor patients or poor pupils and cost effectiveness in terms of cost per patient or pupil. Between these extremes will be a range of intermediate situations such as in roads and water, where there may be technical issues relating to distribution and poverty analysis, but where it should still be possible to do something on the application of these criteria.

Some types of projects may not even fit the mentioned broad categorizations. For example, increasingly adopted sector restructuring projects may not allow well-defined project inputs and outputs to be evaluated ex ante. This type of projects may belong with reform program loans and a distinct framework may be required for their appraisal. Another type of projects which warrants a separate research for distribution and poverty impact analysis would be small- and medium-size enterprises (SME) development and microfinance projects. In this set of projects, financial analysis has only been carried out on indicative enterprises and economic analysis allows only a loose structure for overall project EIRR calculation. Furthermore, financial intermediaries involved in

relending and onlending arrangements would have to involve unique stakeholder identification in the distribution analysis.

One natural question that arises as to economic decision criteria would be whether there should be distributional cut-off threshold that is equivalent to NPV equaling zero or EIRR being equal to the economic opportunity cost of capital. Despite the attractiveness of such idea in view of the overarching poverty reduction objective, it would be unadvisable to implement it as it would allow the possibility of interventions with negative NPV being superior to those with positive NPV, which in turn would lead to economic regress, provided a subjective weighting is not desired as has been discussed in Section II.

In the context of a broad political economy, project selection and design may not be the most efficient way of poverty reduction. Other instruments such as fiscal, monetary, and governance reform campaign may have a greater poverty reduction impact. Projects must take place in the right policy framework. Policy and institutional context of projects, and especially poverty-focused leakage status of the sector of the country should be documented in projects documents.

All the above concerns would have to be addressed in order to formulate a practically workable approach to poverty impact analysis of projects.

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## APPENDIX 1. AGGREGATION PROBLEM IN WELFARE ECONOMICS

How to aggregate individuals' welfare changes into a meaningful measure of social welfare change has been the heart of controversy in applied welfare economics. Presumably based on a utilitarian tradition, a core part of modern welfare economics focuses its analysis on Pareto efficiency. There are different versions of "compensation tests" associated with different degrees of satisfying the Pareto principle. For example, a project is said to pass the Kaldor test if the gainers can hypothetically compensate the losers and still be better off. A project is said to pass the Hicks test if the losers can hypothetically compensate (or bribe) the gainers for foregoing the project and still be better off than they would be when the project took place. It can be shown that a project may pass one of the two tests but fail the other. To preclude such reversals, the Scitovsky test requires both Kaldor and Hicks tests to be passed simultaneously. An essential role of benefit-cost analysis is taken to make sure the selected projects pass the efficiency criterion represented by these compensation tests.

To apply compensation tests, an appropriate measure of an individual's welfare change must be chosen first. It is known that consumer surplus, defined on a Marshallian demand curve, is "path-dependent" and is not a consistent measure of welfare change. For multiple price changes, the measure of consumer surplus varies depending on the particular path that price changes take until a new (general) equilibrium is reached. Unless we limit the analysis to partial equilibrium (which may well be the case in practice), equivalent variation (EV) or compensating variation (CV), defined on a Hicksian demand curve, is the preferred welfare change measure. EV and CV are free of income effects and "path-independent." EV measures the minimum amount of income an individual would require in order to forgo a project that is perceived to be beneficial to her/him. CV measures the maximum amount she/he is willing to pay to have the project take place. Unfortunately, however, summing EV or CV across individuals are not helpful in applying to compensation tests. Boadway and Bruce (1984: 262-271) discuss different patterns of relations between  $\Sigma EV$  and  $\Sigma CV$  and compensation tests and show that neither  $\Sigma EV > 0$  nor  $\Sigma CV > 0$  provides a necessary and sufficient condition to pass either Kaldor or Hicks test. Discouraging news for those who pursue theoretical rigor seems to be that even non-weighted sum of EV or CV is at best a problematic indicator of efficiency improvement.

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Good news for project economic analysis is that as long as we work within a small project assumption, the above problem (referred to as Boadway paradox in the literature) does not arise. When the size of a project's input or output approaches zero (small project assumption), consumer surplus, EV or CV is substituted by a shadow price as a welfare change measure. The role of a shadow price is to attach marginal social value to each unit of input and output involved in the project, and then to be summed up into a net social value of the project. Hatta (1991) defines surplus variation as the amount of net foreign exchange that can be given away in response to a (marginal) project while holding private welfare constant. It can be shown that this surplus variation is equivalent to a shadow price expressed in a foreign exchange numeraire (Fujimura, 1994). Hatta shows that in a many-consumer economy, a positive surplus variation is the necessary and sufficient condition for passing the Kaldor test. This implies that the use of shadow prices within the small project assumption can circumvent the Boadway paradox.

While the use of shadow prices can be shown to be consistent with the efficiency criterion in a many-consumer economy, the problem of distributional consideration remains unresolved. Even when a project passes compensation tests, it will not make all individuals (or households) better off, because in reality costless lump-sum transfers from gainers to losers are unavailable. One obvious departure from the limitation of the social choice based on Pareto efficiency and compensation tests is to accept a well defined social welfare function such as in the form:  $W = W(U_1(c_1), \dots, U_h(ch), \dots)$  where  $ch$  denotes a consumption bundle for  $h$ -th household and  $U_h$  denotes the corresponding utility level. Under this framework, distributional weights among households associated with a certain project will depend on the specific form and parameters the social welfare function takes. The distributional weight for a certain household can be interpreted as the "marginal social utility of income of that household" (say, denoted by  $MSUI_h$ ) relative to the reference household who receives a weight of one.  $MSUI_h$  is decomposed into two parts: marginal social utility (say, denoted by  $MSU_h$ ) and marginal utility of income of the household (say, denoted by  $\lambda_h$ ). Suppose, for example,  $MSU_h$  is equal for all households and  $\lambda_h$  is higher for the poor and lower for the rich, which is equivalent to assuming diminishing marginal utility of income for all households. This would result in a higher  $MSUI$  for the poor and appears satisfying in terms of social justice. However, marginal utility of income is not only unobservable but it necessitates a cardinal utility function. In ordinal

preference, on which modern consumer theory is based, it is irrelevant to ask, for example, how many premium points should be assigned to a household whose income is half of another household. More fundamentally, working under ordinal preference, Arrow (1963) proved that there exists no social orderings that satisfy a minimum set of preferable properties: Pareto principle, non-dictatorship, and independence and transitivity of orderings (Impossibility Theorem).

While theoretical debate on this issue continues in the literature, application to project analysis must make a practical compromise as discussed in the main text.

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## APPENDIX 2. ILLUSTRATION OF RISK ANALYSIS

Table A2.1 illustrates the approach for a simplified project example. Although the numbers are deliberately simplified, the procedure is identical to that required for actual appraisals. The example here is an irrigation scheme which, we assume serves only poor farmers. For simplicity we assume only three groups are affected—the irrigation authority, which runs the project and meets its financial costs, the government which collects taxes from the authority, and the farmers, who are too poor to be included in the tax net. We use a 12 percent discount rate and a five year project life. The irrigation authority meets all costs (the investment cost, operating costs and taxes and collects revenue from the farmers). Irrigation water is charged at a tariff that more than meets all costs using a 12 percent discount rate. Hence, the financial analysis for the irrigation authority shows an expected NPV of 8.81 at 12 percent. The farmers' income flow is determined by the difference between their output value and the extra operating inputs (such as fertilizer and seed) plus the cost of the water itself they require due to the changed techniques employed when they use irrigated rather than rainfed water sources, minus the value of output they would have produced without the project. In other words, we need the incremental position of the farmers due to the project. The net gain to the economy as a whole can be set out as follows:

**Benefits** Incremental farm output (with-project minus without-project value of production)

**Costs** Investment cost of irrigation project (before tax)

Operating cost of irrigation project (before tax)

Incremental farm inputs (with project minus without project value of inputs) excluding payment for irrigation water (which is treated as a transfer between the farmers and the authority).

As indicated in the notes to Tables A2.1 and A2.2, risk analysis can be incorporated into the appraisal by focusing on the probability of project operating costs, farm yields, and water revenue varying from their expected values. For illustration, operating costs for the irrigation authority are taken to have a uniform (or rectangular) probability distribution of 10 percent plus or minus the mean value. In other words, it is taken that there is an equal probability of operating costs falling anywhere within this range. For farm yields, it is assumed that they are distributed normally. However, with the use of irrigation water, it is assumed that variance is considerably lower so that the standard

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deviation is set at 20 percent of the mean, while in the without-project case it is set at 50 percent of the mean. Finally, to allow for the expected positive relationship between farmers income from crops and their expenditure on irrigation water, crop yields with the project and water expenditure are assumed to be correlated with a 0.75 correlation coefficient. Naturally, considerable judgement is required in setting these parameters.

Tables A2.1 to A2.3 give the data and results for the irrigation authority, farmers, and the project as whole respectively. For simplicity, the complications raised by economic pricing are omitted so that in Table A2.3, only transfer payments (taxes and water expenditure) have different economic from financial values. The risk of failure for the Water Authority is 28 percent, and for the economy as a whole it is 34 percent. From a poverty point of view, it is the risk of failure for the poor farmers that is of critical concern. This is higher at 41 percent. The intuitive explanation for this is that the possible variations each year are higher relative to the expected annual net benefit for the income flow for farmers than for either the Water Authority or the economy as a whole. 41 percent risk of failure is relatively high and the implication is that ways should be sought of ensuring that the possible variations in farm yields are not as great, so that actual figures are closer to projected mean values.

Table A2.1. **Income for Water Authority**

Years	1	2	3	4	5	6			
Revenue (a)			0		50	50	50	50	50
Costs									
Investment			90						
Operating (b)					18	18	18	18	18
Tax (c)			9		1.8	1.8	1.8	1.8	1.8
Net			-99		30.2	30.2	30.2	30.2	30.2
Expected NPV at 12%	=				8.81				
Probability of NPV < 0	=				28%				

Notes: (a) Revenue is correlated at 0.75 with farmers' income from new crops.  
 (b) Operating costs are assumed to have an equal probability of being 10% above or below 18.  
 (c) Tax is 10% of all costs.

Table A2.2. **Income for Farmers**

Years	1	2	3	4	5	6
Revenue (a)	0	110	110	110	110	110
Costs						
Fertilizer/seed	0	15	15	15	15	15
Water (b)	0	50	50	50	50	50
Opportunity cost (c)	0	40	40	40	40	40
Net	0	5	5	5	5	5
Expected NPV	=		17.23			
Probability of NPV < 0	=		41%			

Notes: (a) Farmers revenue is value of new crop output with the use of irrigation water. It is assumed to be normally distributed around 110, with a standard deviation 20% of the mean.  
 (b) Water payment by farmers is the same as water revenue for the water authority. It is assumed to vary with change in farmers' revenue with a 0.75 correlation coefficient.  
 (c) Opportunity cost is the crop income without the project. It is assumed to be normally distributed around 40 with a standard deviation 50% of the mean.

Table A2.3. **Total Income for the Economy**

Years		1	2	3	4	5	6
Revenue (a)		0	110	110	110	110	110
	CF (b)						
Costs – Project (c)							
Investment	1.0	90	0	0	0	0	0
Operating	1.0	0	18	18	18	18	18
Tax	0	0	0	0	0	0	0
Costs – Farmers (c)							
Fertilizer/seed	1.0	0	15	15	15	15	15
Water	0	0	0	0	0	0	0
Opportunity cost	1.0	0	40	40	40	40	40
Net		-90	37	37	37	37	37
Expected NPV	=	38.73					
Probability of NPV < 0	=	34%					

Notes: (a) Economic benefits are farmers revenue from Table A2.2.

(b) Conversion factors (CF) are used for economic pricing. Only taxes and water payments have CFs different from unit, which are simply zero as they are transfers.

(c) All costs come from Tables A2.1 and A2.2.

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