

**PROJECT INVESTMENT AND PROGRAMMING UNIT**

**Distr.  
LIMITED**

**LC/IP/L. 81  
23 June 1993**

**ORIGINAL: ENGLISH**

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IMPACT ASSESSMENT: A NECESSARY BUT COMPLICATED  
THEORETICAL BRIDGE**

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- \* This document was originally published in the magazine Development Policy Review, vol. 10, No. 3, 1992 (London, Newbury Park, and New Delhi, Sage). Its translation and reproduction were officially authorized by the magazine. The opinions expressed herein are the sole responsibility of the author, and do not necessarily reflect the views of the Organization.

**SOCIAL PROJECT APPRAISAL AND ENVIRONMENTAL IMPACT ASSESSMENT:  
A NECESSARY BUT COMPLICATED THEORETICAL BRIDGE**

**Diego Azqueta <sup>1/</sup>**

In a recent issue of this journal, James Winpenny argued forcibly in favour of incorporating **environmental values** in the framework of **social project appraisal**, as a way not only to improve the selection of projects, but also to give a truer measure of economic performance, and to help to resolve disputes and to decide on the amount and the beneficiaries of potential compensation payments (Winpenny, 1991). His article presents a comprehensive, well developed survey of the reasons favouring this integration, and the benefits to be obtained from it. His argument attempts to dispel the fears of environmentalists, towards something perceived as an unfortunate mixture of neoclassical economics and market mechanisms, which can only mean disaster for the environment as a whole. There is nothing to object, in my opinion, to Winpenny's position, once the limits of the market are recognized, along with the main shortcomings of the techniques developed to value environmental impacts. It is not my purpose here, however, to continue the discussion along these lines.

What I want to argue is simply that, once Winpenny's main position (which is really the statement of something desirable) has been accepted, the problem of implementing it is quite complicated. And this, not only because of practical difficulties, hardly underestimated, but more important still, because of two related issues:

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a) On the one hand, because there is a very important theoretical gap between the two sides of the equation that need to be linked together: **social project appraisal (SPA)** and **environmental impact assessment (EIA)**, have a very different theoretical backgrounds.<sup>1/</sup>

b) On the other, because if EIA is to be properly introduced in SPA, it would require the modification of some major **accounting prices**.

It is precisely these two points that I would like to develop here in some more detail.

To do so, let us begin by stating an obvious fact: Both SPA and EIA, as branches of **social cost-benefit analysis (SCBA)** arise from a common concern: the search for an increase in **social welfare**, through achieving a better **allocation of resources**, in the presence of some **market failures**. As is only too well known, however, there are two very different kinds of market failures: those arising from serious imperfections in existing markets, leading thus to **distorted prices**; and those arising from the absence of markets for certain goods (externalities, public goods, common resources), which leads to the **absence of prices**. Unfortunately, whereas SPA centered analysis on the former, EIA (because of its very nature), focused on the latter, referring in each case, for the development of their proposals, to different theoretical frameworks.

### 1. Social Project Appraisal and Development Economics

SPA, as the branch of SCBA more often applied to the problems of Third World countries, consolidated itself in the first half of the seventies, thanks to the works of authors like Little and Mirrlees (1969 and 1974), Sen, Dasgupta and Marglin (1972), and Squire and van der Tak (1975), made on behalf of major donor agencies: OECD, UNIDO, and the World Bank.

In evaluating development projects, all these methods specified a very similar **social welfare function**: i.e. they had in common one particular social objective. This common social goal was, of course, **economic development**.

Now, according to the specialized literature, economic development has been defined as the combination of a sustained rate of growth of income per capita, on the one hand, and an improved distribution of it, on the other. Therefore, all three manuals accepted this starting point, and went even further, separating the treatment of these two different aspects:2/

- a) In the first place, the growth component was somewhat reduced to an increase in consumption (UNIDO), or in public income (OECD-World Bank). The **growth rate** was therefore displaced out of the picture because it was argued, rightly, that to introduce this time perspective, implied a judgement about the value of future consumption, in terms of consumption now: a distributive parameter. To cope with this first objective, an increase in consumption or in public income, **efficiency accounting prices** were introduced, leading to an **economic appraisal** of projects (see note 1).
- b) In the second place, and as for **equity** considerations, the **social appraisal** of projects was to be carried out by introducing some **distributive parameters** which should allow the valuation of the distributive impacts of the project under consideration: personal, regional and temporal. Alongside, some of the former prices would emerge as **social accounting prices**.

Both components of the main objective, **efficiency and equity**, were thus clearly distinguished, and dealt with in two different steps:

When facing then the problem of **efficiency**, all these authors focused on the main issues which, according to Development Economics, constituted the principal bottlenecks in the path of development: **savings**, and **foreign exchange** constraints.3/

- a) The **foreign exchange constraint** led to the main proposal of the OECD-World Bank method: the use of **international prices**, for traded commodities, and the application of particular **conversion**

**factors** for non-traded ones. These **conversion factors** were to be calculated with the help of semi input-output tables and should, ideally, reflect the equivalent foreign exchange component of those commodities' production costs.

The UNIDO Guidelines, being symmetrical to the previous method, relied heavily on the crucial role played in it by the **shadow exchange rate**.

b) The importance of the **savings gap**, on the other hand, with its corresponding premium to investment over consumption, and taking into account that it relates to a distributive issue (Consumption now versus consumption in the future), was reflected in the value of some of the major **distributive parameters**, and in one of the most important **accounting prices: the social wage rate**.

Coupled with this main approach, some specific aspects of these countries, which had been very important in the framework of Development Economics, were also introduced into the picture: the problem of surplus labor and **disguised unemployment** in the **traditional sector** of the economy, is a case in point.4/

Therefore, the main theoretical debate that arose from these proposals gravitated around the identification of the principal obstacles in the development process, and the validity of the solutions advanced to overcome them: the discussion about the correct value of the **shadow exchange rate** exemplifies this well.5/

In any case, and whatever the outcome of the debate, the set of **accounting prices** calculated to carry out the appraisal of projects, reflected almost exclusively this concern with **foreign exchange constraints**, in a situation characterized by widespread open and/or **disguised unemployment**, and a **suboptimal savings rate**.

Externalities were mentioned, but were not dealt with in any operational sense.6/

## 2. Environmental Impact Assessment and Welfare Economics

On the other hand, EIA originated from a very different theoretical framework, namely, the treatment of externalities and public goods, when trying to achieve **Pareto Optimality**, in a situation characterized by a particular instance of market failure: the very absence of markets for some commodities. In this sense, and looking more specifically to the problem of valuing environmental impacts, EIA has been considered simply as a branch of **Applied Welfare Economics**.

This analysis, from a theoretical perspective, has centered thus around three basic issues:

- a) In the first place, much study has been devoted to the problem of which is the best **measure** of individual welfare change. In this sense, the discussion has focused on the relative advantages of three measures put forward in the literature: **consumer surplus**, and the two Hicksian proposals of **compensating variation** and **equivalent variation**. Usually the problem has been posed in terms of whether to choose a **willingness to pay** or a **willingness to accept** approach, to value some particular change in welfare.<sup>7/</sup>
- b) Secondly, and somewhat related to the previous issue, is the problem of **aggregating** these individual welfare changes to arrive at a measure of the resulting **social** change. This problem can also be subdivided into two further ones:

First, the issue of **whose** welfare is to count: who is to be considered affected by what is happening, in the sense of introducing his or her welfare changes, whatever the way by which they have been computed, into the **Social Welfare Function**. In the field of environmental goods, this problem usually takes the form of deciding whether only **use values** are to count, or, alternatively, whether the stage is also open for **non-use values** (option, bequest, existence...). From an empirical point of view, the issue is far from irrelevant, as the work of many authors has shown: Pearce and Turner (1990, p. 139-140).<sup>8/</sup> The problem of

how to introduce the interests of **future generations** is relevant here as well.

Secondly, we find the old and well known problem of which **criteria** to use, to proceed with the aggregation exercise, and which needs not to detain us here.

c) At a different level, the third problem, and probably the more important one, at least in terms of resources devoted to it is, the concern with the means to **discover** these welfare changes, in a situation in which, by definition, the individual does not explicitly reveal his preferences. The problem of the best **elicitation** procedure leads to the proposal of different methods to cope with it, some of which are mentioned in Winpenny's work: **hedonic price functions, travel cost, contingent valuation...** Although the concern in this case is fundamentally a practical one, theoretical issues are not absent from the discussion: most of them have to do with the underlying properties of the individual utility function (Mäler, 1985).

The main issues at stake are then:

- how to measure better individual changes in welfare
- how to select those individuals whose welfare is to be taken into account
- how to discover the individual valuation of those changes, and
- how to aggregate them.

They have therefore, nothing to do with development problems, neither from a growth perspective (foreign exchange and savings constraint), nor from a distributive one, with the very important exception of the role of future generations.

Summarizing then the argument developed until here, it can be said that both SPA and EIA were born to help provide a more **efficient** and **just** allocation of resources, in response to certain market failures. Whereas former concentrated on solving problems of already existing prices in situations characterized by serious disequilibria in labour, capital, and foreign exchange markets, the latter tried to value those goods lacking an explicit price. In

doing so, however, SPA relied on Development Economics for its theoretical foundations, whereas EIA turned itself into Applied Welfare Economics. This very important difference was only the reflection of a deeper one, the **difference in social objectives** underlying each one: the process of development, on the one hand, collective and dynamic; and individual welfare, on the other.

In these circumstances the bridge between the two approaches, whose theoretical development has run along parallel lines with very few points of contact, is not an easy one, and the traditional practice of integrating both in SPA suffers from serious shortcomings.

### 3. EIA and SPA: the Problems of the "Traditional Procedure"

The traditional practice which recommends integrating EIA into SPA, what Pearce, Barbier and Markandya call "Extended Cost-Benefit Analysis" (Pearce et al, 1990, p. 58), and the one recommended by Winpenny, consists of the following procedure:

Taking for granted that the project subject to consideration has some well identified environmental impacts, these should be valued according to the techniques put forward by Environmental Economics, and simply added to the main stream of costs and benefits already calculated, in the main Project Appraisal exercise. Therefore, a new column of net Environmental Benefits would appear which, added to the previous net Economic (or Social) Benefits, would allow the evaluator to calculate the corresponding Net Present Value (NPV) of the Project, or its Internal Rate of Return (IRR).<sup>9/</sup>

This procedure, however, suffers from two very serious shortcomings:

a) On the one hand, both streams of costs and benefits have been arrived at with the help of techniques based on different theoretical backgrounds and, as we saw, implying different social objectives.

b) On the other hand, it is incomplete: the costs and benefits taken into account in the SPA exercise, do not include the environmental impacts related to the provision of goods and services, required for the development of the project as such. The reason is simply because the methodology used for this purpose does not consider them. In other words, "backward environmental linkages" should also be included in the evaluation process.

Let us develop these two points in some more detail.

To do so, we will concentrate on analysing some of the most important **efficiency accounting prices** utilized in SPA, pointing at what we perceive as the major changes that EIA requires of them, and suggesting some ways to cope with it. Taking into account that **environmental values** are to be introduced in SPA, and not the other way round, we assume that **economic development** is the relevant social objective. We will also limit the discussion to **economic appraisal**, i.e., considering only **efficiency** aspects.

### 3.1 Environmental Values and Efficiency Accounting Prices

EIA is carried out with the help, as was mentioned above, of **efficiency accounting prices**. In the OECD-World Bank methodology, these prices tend to compute the costs or benefits, in terms of **foreign exchange**, of producing a good, or of consuming some particular input of production. For traded goods, **international prices** are used.<sup>10/</sup> For non-traded ones, the corresponding **conversion factors** tend to value the foreign exchange costs of producing them.

In either case, the production and distribution of these commodities will have, in all probability, some impact on the functions of the environment: whether by using the stock of natural resources (raw materials, energy...); modifying the value of environmental services (life support, recreation...); or producing a flow of residuals which the environment has to assimilate (Bojö et al, 1990, p. 19). Yet, when computing these costs of production and distribution, **natural resources** will appear valued, if at all, at their corresponding **international price**, which probably will not

reflect all environmental costs associated with its use. Thus, the **efficiency accounting price of electricity generation, or construction, or transportation**, should not only take into account the costs associated with the use of foreign exchange, labour and land, but also all those related to the use of the environment.

The analysis is, therefore, incomplete, simply because in the process of calculating **accounting prices**, no room was left for including these environmental impacts.

And here is where one of the problems already pointed out appears. The environmental impacts of producing and distributing commodities affect social welfare in two ways: first, by possibly jeopardizing the development process itself; second, by reducing individual welfare, when affecting some inputs of the utility production function. These two different kind of impacts, however, do not lend themselves easily to equal treatment.

a) In the first case, a process of recalculating **accounting prices**, to include all these **environmental impacts** as they relate to the concept of **sustainable development**,<sup>11/</sup> is called for.

The task is quite a difficult one, given the yet incipient development of "Green Accounting". One interesting possibility, however, could be derived from the work of Bojö, Mäler and Unemo (1990). The authors recommend, in fact, the expansion of the **Social Accounting Matrix (SAM)** framework, so as to introduce environmental impacts.

Their proposal can be illustrated, at quite an introductory level, by adding two new rows to a very simple SAM: oil use, and sulphur dioxide emissions. In this way, the environmental impact (reduced to these two items) of producing, say, a further unit of agricultural products, or energy, could be recorded.

Unfortunately, the SAM framework is a very aggregated one: it deals with entire sectors of the economy, rather than with commodity-specific productive sectors. Nevertheless, some of the most important **commodity accounting prices** used in SPA have to do, precisely, with this kind of aggregated production: the **conversion factors** of electricity, construction, transportation, etc. remit to

the kind of sector which could be encountered in some SAM's. The proposal seems to be, therefore, a first step in the right direction, until more precise information regarding the impact on **sustainable development** of specific commodity production is available. In any case, once the impact (oil use, sulphur emissions) has been recorded in physical units (what the literature calls the **dose-response** relationship), it has to be converted into a **welfare change**. The economic valuation of these impacts should be undertaken therefore, according to this objective, regardless of which operational definition of it is accepted.

b) The second one, however, relates to the fact that this use of the environment may have an impact on the **utility production function** of individuals, through its effects on the flow of some particular environmental services: recreation, beauty... In this case, the techniques developed within Environmental Economics would be called for, once the **dose-response relationship** has been established. It is important, in any case, not to lose sight of the serious caveats that many authors have issued regarding the applicability of these techniques to non-developed countries.<sup>12/</sup>

An added problem appears in this context, unfortunately, to further complicate matters: the welfare changes introduced by these environmental impacts depend on **where** do they occur (i.e. on the population affected). Therefore, they cannot be calculated, in principle, on a national wide basis: the negative impacts of coal-fired electricity generation on this account (affecting visibility, health, etc., **sustainable development** having been dealt with already), depend on the number of people living in the surrounding area who are affected by it. They are, thus, **site-specific**, which complicates the use of extended SAM to calculate a new family of **accounting prices**.

### 3.2 Environmental Impacts and the Efficiency Price of Foreign Exchange

We turn now to a methodology symmetrical to the former one: the UNIDO Guidelines. The crucial **shadow price** is, in this case, the **efficiency accounting price of foreign exchange**. With its help, all movements of foreign currency are revalued to reflect the true value for the economy of this particularly scarce commodity. The way to do it is, simply, to calculate the value, at world prices, of a particular basket of internationally traded consumption goods and services, and to compare it with the value of this same basket at local prices. The divergence between these two set of prices reflects the degree of protection of the economy and, in part, of the balance of payments problems. It could be assumed then that the greater those problems, the higher the divergence (fewer import permits, stricter quotas, higher tariffs...), and the higher the **accounting price** of foreign exchange.

The "equilibrium" of the balance of payments under these conditions has been achieved, however, not only with the help of all these restrictive measures, but also thanks to the inflow of foreign exchange obtained through some export lines, which may not be that welcome once their environmental costs are taken into account. The Indonesian exports of timber products offer a good example of it. According to World Bank figures, quoted in Pearce, Barbier and Markandya (1990. ch. 5), "in 1986 they earned over US \$ 1.2 billion, which amounted to approx. 20% of non oil and 6.5% of total exports. By 1987-8 sawn timber and plywood exports alone accounted for over 14% of total merchandise exports" (p. 96). This quite substantial amount both in absolute and relative terms surely would have eased, to some extent, the balance of payments situation and, therefore, kept lower than otherwise the premium of foreign exchange: its **accounting price**. Yet, if all the costs of these exports were taken into account (including, of course, the environmental services foregone because of it), it is doubtful whether there would be any net benefit left: this line of exports may well end up not being justified in economic terms. But, if

this were the case, the balance of payments situation would be much worse and, correspondingly, the **accounting price of foreign exchange** much higher.

To summarize the point: the project being evaluated may have nothing to do with timber harvesting. It may have a moderate negative environmental impact which, when added to the main stream of economic costs and benefits, still provides a positive NPV. It may happen, however, that the project has a negative impact in foreign exchange terms (it consumes more dollars than it generates). This will be duly penalized applying the **accounting price** of foreign exchange. In the situation depicted above, however, this **accounting price** undervalued the real cost to the economy of foreign exchange. It could be the case then that, when revalued to reflect the actual scarcity of foreign exchange, the project is no longer economically attractive. And this, not because of any negative environmental impact of the project itself (which the traditional practice would have accounted for), but because the **environmental costs of generating foreign exchange** have now been included into the analysis.

As some countries are revising their GDP and growth rate figures, so the **accounting price of foreign exchange** should be recalculated, to take account of the real costs of maintaining some kind of "equilibrium" situation.

### 3.3 Environmental Values and Accounting Wages

As it is well known, one of the most important **accounting prices** is the one related to the costs of labour: the **efficiency accounting wage**. As such, this shadow wage should reflect the economic costs associated with the creation of a new job. Traditionally it includes:

- a) Direct output foregone: the value, at **accounting prices**, of the marginal productivity of labour in the alternative sector (the sector that eventually loses the worker).
- b) Indirect output foregone, as a result of the impact of this new job opening on migration flows: the change in the probability

of getting a job in the modern (protected) sector that this creation entails, may induce the migration of more than one worker from the traditional sector. A simple result of the application of Todaro-type models of migration makes it necessary to distinguish whether the job is created in urban or in rural areas.

c) Urbanization and accommodation costs: any further spending needed, usually from the government, to accommodate the new workers and their families (housing, urban infrastructure, schooling, health services, etc.).

Leaving aside distributive aspects, and keeping therefore the analysis in the field of **efficiency prices**, these are the items traditionally included in shadow wage formulations.

This process of job creation, and the accompanying labour migration, nevertheless, may imply some important effects regarding the environment. To only point out the most obvious ones:

a) This potential process of urbanization of the labour force will, in all probability, imply a change in the **patterns of consumption** of the population affected. Some of these changes will be detrimental to the environment (transportation needs, waste disposal, use of plastics...), while others may be beneficial, like the substitution of wood as a source of heating (Bojö, Mäler and Unemo, 1990).

b) Migration will probably aggravate the already dramatic problems of urban centers in non-developed countries. On the other hand, it may imply a process of desertification in the areas abandoned, or, on the positive side, less pressure on water resources, forests, grazing land, etc.

c) Finally, the "insurance effect" of this process of job creation in the modern sector should be mentioned. It only reflects the fact that, when the migrant finally gets a job in the modern sector, he or she acquires a flow of earnings which, from the point of view of the whole family, may act as an insurance, allowing the adoption of more efficient techniques in agriculture, not implemented before because of the risks involved: the mathematical expectation of yield values is higher with the new

technique, but so is the variance associated with it. If the farmer cannot risk the prospect of a "bad" year because, for example, of simple starvation, he will in the absence of any insurance rationally adopt the "traditional" technique: apparently less "efficient", but more secure.

This fact, once accepted as relevant, requires a revision of the traditional formulae used to compute **accounting wages**: the creation of a job in the protected sector may enhance productivity in agriculture, thus augmenting the production of commodities.<sup>13/</sup> From the point of view of the environment, it may also be relevant if this "insurance policy", or the very fact of counting with a new, reliable source of income, implies the adoption of soil conservation techniques (Bojö, Mäler and Unemo, 1990).

It may be argued that the conventional practice will take into account all these environmental impacts, and therefore the discussion here is close to irrelevant: the new column of **Net Environmental Benefits**, to be added to the SPA exercise, will surely include the desertification effects of migration, the pressure of the new established population on existing water resources, the adoption of new agricultural techniques thanks to migrant remittances... This is necessarily so, if a proper EIA is to be performed.

But, in any case, and provided all these impacts have been recorded and valued, the traditional practice severs the link between them and their origin: the process of job creation. These environmental impacts appear as an effect of the investment as a whole, whereas they really originate in one of its **characteristics**: the employment (plus migration) effect. To introduce this qualification is not an exercise of spurious precision: the distinction can be quite important in the context of the **choice of techniques**.

These environmental impacts of job creation should be included, therefore, in the **accounting wage** expression, rather than in an independent way.

### 3.4 Environmental Values and Discounting

Finally, we end up with one of the most controversial issues in this field: the problem of discounting.

The discussion, as it is only too well known, centered around the proposal put forward by some environmentalists, in the sense of lowering discount rates (when accepting discounting at all) as a means of better protecting the environment. In this way, it has been argued, we do not discriminate against the future, and environmental values will be better preserved. This presumption, however, seems to be based on very weak foundations indeed, as the work of Krutilla and Fisher (1985), Porter (1982), Pearce, Barbier and Markandya (1990, ch. 2), Markandya and Pearce (1991), and others, has shown.

I would instead like to concentrate on the very meaning of discounting in SPA, and on how this operation should be adapted, to take proper care of environmental issues.

Discounting in project appraisal, as elsewhere, is the operation through which the fact that the future is less valuable than the present is taken into account: the **numeraire** (the common unit in which costs and benefits are expressed), becomes less worthy with the passing of time. The rate of discount is, therefore, the rate at which the numeraire loses its value, as time goes on.

Now, in SPA, there has been two main numeraires: **consumption** (in the UNIDO Guidelines), and **public income** (in the OECD-World Bank method).<sup>14/</sup> **Two different rates of discount** are then required: the **Consumption Rate of Interest (CRI)**, in the first case, and the **Accounting Rate of Interest (ARI)**, in the second.<sup>15/</sup> Now the question arises:

Does the introduction of environmental impacts affect the way in which these rates are calculated and/or utilized, in SPA?

The answer, in my opinion, is affirmative.

To prove it, let us see how the value of these two rates is obtained:

a) The **Consumption Rate of Interest (CRI)**, is calculated, basically, as a function of three parameters:

- The **pure time preference rate**,
- The **expected rate of growth** of the economy,
- The **elasticity of the marginal utility of consumption** schedule: a value judgement reflecting the social opinion on the relative weights of different income groups.

We agree with the opinion of those who sustain that the **pure time preference** factor should not be included into the **social rate of discount**: impatience, or mortality, needs not characterize society.<sup>16/</sup> Risk and uncertainty considerations (including irreversibility) are better handed through means other than manipulating discount rates (Pearce, Barbier and Markandya, 1990, ch.2). In any case, the decision whether to include this motive or not into the discount function has to be arrived at by taking into account a set of considerations, which will not be modified by the introduction of environmental issues.

This is not the case, however, when turning to the **growth rate**. The reason for including its value into the discount rate is straightforward: once accepted the principle of the **diminishing marginal utility of consumption**, the future is less valuable because, it is assumed, the level of consumption will be greater, how much greater depends, precisely, on its rate of growth. How less valuable, on the elasticity already mentioned.

It is assumed, therefore, that the rate of growth is going to be positive: otherwise, the rate of discount could end up having a **negative value**, something odd, but not illogical: the future is more worthy, because people are expected to be worse off.

In any case, it is important to draw attention to the fact that, as it has recently been recognized, growth rates estimations have tended to overestimate country performance, because of a neglect of environmental factors and the requirements of **sustainable development**: natural resources depletion, for instance, has not been considered when computing those rates.<sup>17/</sup> Not are other environmental factors mentioned that have a direct impact on

welfare and should warrant, also, a recalculation of growth figures. When all these considerations are taken into account, the **Consumption Rate of Interest** will probably result in having lower values.

As for the third component, the **elasticity of the marginal utility of consumption**, it is a distributive parameter (a value judgement) that, in my opinion, is not affected by the introduction of environmental issues: the relative weight given to lower, vis a vis, higher income groups (whether in the present or in the future) is a political decision. The only sensible recommendation, in this respect, seems to be to stress once more the importance of conducting a thorough **sensitivity analysis**, with different values of the parameter.

In any case, the process of calculating the value of the **CRI**, is affected when introducing environmental factors (which should be considered anyway), through their influence on the value of the **expected rate of growth** of the economy.

b) The **Accounting Rate of Interest (ARI)**, used in the OECD-World Bank methodology, is calculated from a very different starting point. Being uncommitted **public income** its numeraire, this rate of discount plays the role of equalizing the supply and the demand of it. As such, it is equal to the **Internal Rate of Return (IRR)** of the best **excluded** investment project: the first one in the waiting list.<sup>18/</sup> In this way it guarantees that the budget is exhausted by all projects having a positive **Net Present Value (NPV)**. It is also consistent with the **Social Opportunity Cost of Capital** approach which characterizes this procedure: it reflects the profitability of public income, in the best alternative foregone.

In equilibrium, these two rates (ARI and CRI) should be equal; in other words, if investment and consumption are equally valid, their loss of value over time should be the same: there would be no reason for the respective discount rates to differ. However, because of the suboptimal rate of savings and investment, they are not equal ( $CRI > ARI$ ). This situation would typically be one where "absorption capacity" is lacking: the economy is so backward that

the lack of human capital, skilled labour, prevents it from profitably exploiting the resources that the rest of the world provides it.

Such inequality between the two rates would also occur when the economy is so underdeveloped that it is unable to profitably utilize the investment resources which the Government obtains from domestic savings.

In any case, if the process of appraising different projects has been correctly performed (i.e., including all direct environmental impacts, and utilizing **accounting prices** which reflect all indirect ones), the resulting ARI would require no further adjustment, provided the size of the investment budget (the supply side of the equation to be balanced), is not affected because of the environmental impacts, both direct and indirect of the projects under consideration.

Up till here we have been dealing with the problem of how environmental issues affect the way discounting is performed, irrespective of whether the project itself has any discernible environmental impact.

When this is the case, however, (the project has a **direct** environmental impact), the difficulty of having two discount rates reappears. The reason is simply that, in all probability, this impact will have the two dimensions already mentioned: on **sustainable development**, and on individual **utility production functions**. The traditional practice, as we saw, tends to add both into a single column of environmental impacts. Yet, these two effects, should not be mixed together. This is because, in the first case, the project is affecting the process of development in the same way as **investment** does, whereas in the second one, it is changing the welfare derived from the **consumption** of certain goods. Before adding them, therefore, they should be reduced to a common unity. Whether the numeraire is **public income** or **consumption**, it will depend on the methodology used: in any case, the **accounting price of investment**, or the inverse of the **consumption value of public income**, will do the job. Be it as it may, only then the new

column will reflect properly these direct environmental impacts, and would be ready for discounting, using the corresponding rate.

#### 4. Summary and Conclusions

The environment is no longer the textbook example of "free" goods that it used to be not so many years ago, when air and water, for example, were considered non-economic goods. Nowadays, it is universally accepted that the environment may not have an explicit (over the counter) price, but surely has a value. And this because it performs three types of functions which have a clear economic value.

- a) a source of natural resources, relevant for the production of many goods and services; and environmental services which enter utility production functions,
- b) an assimilator of waste,
- c) a life-support system which guarantees the continuity and diversity of life in the planet.

As a result, **environmental impact assessment** of investment projects, and economic activities in general, has become a common practice in many developed countries, being even mandatory in some of them.

In the case of non developed countries, the situation is somewhat more complicated. The perception of the environment as a **consumption good** (as an important argument of the utility production function of individual consumers), and a superior one for that matter, is not so widespread: there are more urgent and acute needs to be concerned about. Yet, the neglect of environmental aspects may seriously jeopardize the very **sustainability** of the development process. This consciousness, together with some pressure from the developed world, because of the public good character of global environment, have led to an equally increasing concern with these problems in Third World countries.

One of the most clear examples of this tendency has been the ever growing literature on the "environmental impacts of development projects" (to quote the title of a very well-known textbook), and the search for a way to integrate **environmental impact assessments** in the traditional social project appraisal framework.

There is nothing to object to in this idea. Yet, some reservations are in order, regarding the different theoretical background of the two parts that are supposed to merge, on the one hand; and the shortcomings of the traditional way of integrating them, on the other.

The first problem appears because, whereas **environmental impact assessment** has developed itself as a branch of **applied welfare economics**, focusing mostly on individual welfare changes in the context of advanced economies; **social project appraisal** is nothing but **applied development economics**, having to do with the major bottlenecks in the development process (savings, foreign exchange, income distribution), in the context of poor countries. Thus, while the former emphasizes the **consumption** aspects of environmental services; the latter, if at all, stresses its role with regard to the **sustainability** of the development process. The merge, therefore, is not an easy one from a theoretical point of view.

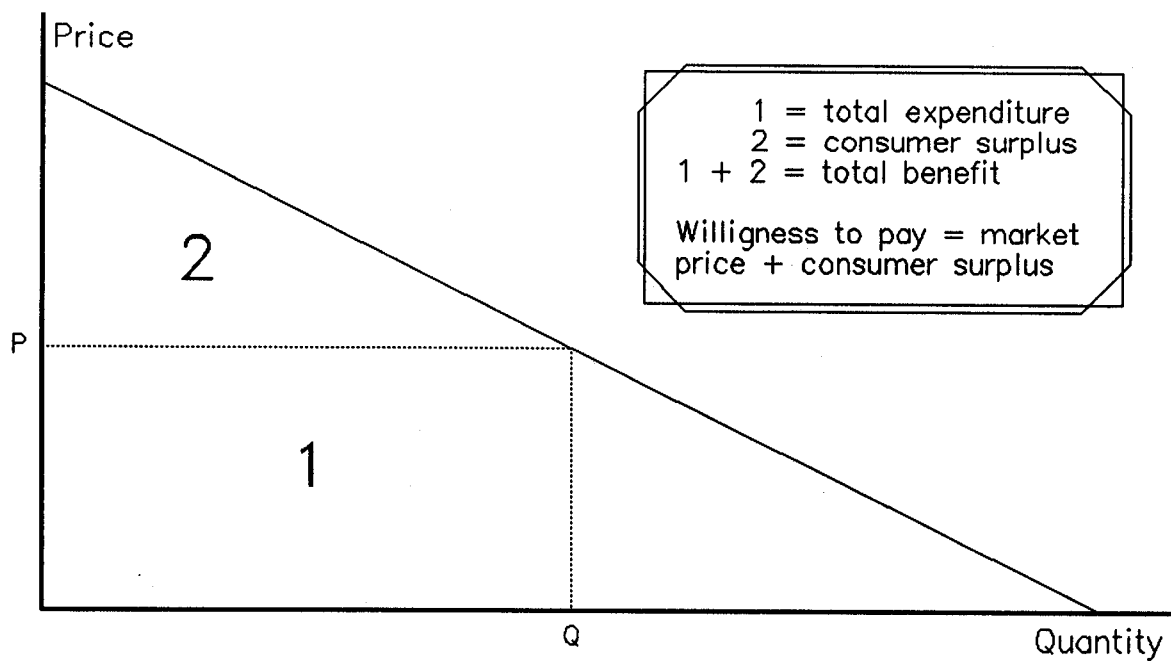
The second problem is of a more practical nature.

When incorporating EIA into SPA, "traditional practice" has recommended the **extension** of **project appraisal** to include a new column of **net environmental impacts**, which can be added to the already obtained net economic (or social) benefits, to end up with an indicator of the global NPV of the project.

In our opinion, this procedure is incomplete, because it does not take into account the **backward environmental linkages** of the economic activity being appraised. To integrate properly EIA into SPA, we have to take into account all **direct** and **indirect** environmental impacts of the project; and we must relate each

impact to its cause within the project being evaluated. This requires us to modify the value of some of the most important **efficiency accounting prices** traditionally used in SPA.

An illustration of this was provided for the cases of commodity accounting prices; the shadow exchange rate; the efficiency accounting wage; the consumption rate of interest; and the accounting rate of interest.

**CONSUMER SURPLUS AND WILLINGNESS TO PAY**

### Notes

1/ In the remainder of the text, unless otherwise stated, I will use the following terminology:

**Social Cost-Benefit Analysis:** the general framework in which the search for a way to overcome market failures in the process of achieving an optimal allocation of resources is applied to the analysis of different policy measures (most notably, public investment).

**Social Project Appraisal:** this branch of SCBA applied to the problems of non developed countries. In formal terms, we should distinguish **Economic Project Appraisal**, where only **efficiency** considerations are taken into account, from **Social Project Appraisal**, where **efficiency** is coupled with **equity**. Therefore, this use of the term is somewhat inappropriate, but we will maintain it because of its intuitive appeal.

**Environmental Impact Assessment:** this branch of SCBA attempts to overcome the difficulties arising from the non-existence of markets for some particular commodities (externalities, public goods, common resources), in the context of evaluating the relative advantages of some particular investment.

2/ It should be added that the UNIDO Guidelines included some other social objectives (national independence, female employment...) which, however, are not relevant for our purposes.

3/ The two-gap analysis models (McKinnon, Chenery, in the 60's; Bacha, Taylor, in the 80's), are the main theoretical reference in this sense.

4/ On the other hand, the very important theoretical developments which appeared during the 70's in the field of rural-urban migration, the urban-informal sector, and the supply price of labour under these circumstances, were only slightly incorporated in the main framework.

5/ The debate, which focused on the appropriate **shadow price** of foreign exchange, under different circumstances, touched on almost all theoretical problems that appear when constructing a set of **efficiency accounting prices**. See, for example: Balassa (1974), Bell and Devarajan (1983, 1989), Bruce (1976), Dinwiddie and Teal (1986, 1989a, 1989b), Srinivasan and Bhagwati (1978), Tower (1984), Tower and Pursell (1986).

6/ It may be added that there was an implicit but very deep suspicion about introducing them into the analysis: economically unsound projects could be sustained because of some allegedly major impact in this field. This is very difficult to disprove, so it was argued, in the face of vested interests, due to the weaknesses of the theoretical treatment of externalities, from the point of view of its valuation.

7/ The discussion gained momentum, once its importance from an empirical point of view was realized, denying the early optimism of authors like Freeman (1979), Randall and Stoll (1980), or Willig (1976). See for example: Brookshire and Coursey (1987), Gregory (1988), Hanley (1988), Mitchell and Carson (1989), etc.

8/ For a highly critical position regarding the relevance of these non-use values, however, see Freeman (1990).

9/ Alternatively, at the **programme level**, a **shadow project** is introduced, its aim being to compensate for the environmental damage originated from the other projects in the portfolio: the **environmentally compensating project**, and added to it (Pearce, Barbier and Markandya, 1990, ch. 3).

10/ To be more precise: the marginal revenue, or the marginal cost (depending on the case), of importing or exporting one more unit. We assume infinite elasticities of demand, or supply, to ease the argument.

11/ The concept of **sustainable development** is far from unique. Introduced in the World Conservation Strategy (1980), and adopted by the World Commission on Environment and Development (the

Brundtland Report) in 1987, it has experienced since then a meteoric career (Bojö, Mäler and Unemo, 1990, p. 13). This development has led to the concept having different meanings, and not all of them compatible with each other: Bojö et al (id), found six different meanings of it only within the Brundtland report. Pearce, Markandya and Barbier (1989) introduce a "gallery" of more than 20 different definitions. Some **operational** versions of the concept, however, have also emerged: see, for example, Pearce, Barber and Markandya (1990, ch. 1).

12/ Reservations which are very serious indeed in the case of one of the most important environmental impacts of many projects: those regarding **human mortality and morbidity**. The methods used to estimate the welfare values associated with changes in mortality and morbidity rates (**hedonic wage functions, cost of illness approaches, contingent valuation exercises...**) are really ill-suited for non-developed countries. For a sample of three different approaches to value changes in mortality and morbidity rates see: Gerkin and Stanley (1986), Jones-Lee, Hammerton and Philips (1985), and Marin and Psacharopoulos (1982).

13/ For the importance of this factor see, for example, Lucas (1987).

14/ The distinction would be really operative in **social project appraisal "strictu sensu"**, i.e., when the introduction of **distributive** considerations will make the value of a unit of **consumption** different from the value of a unit of **investment** (public income, when the marginal propensity to invest of the public sector is unity).

15/ In reality, the two rates are used in the two methods: one for discounting purposes (the CRI in the UNIDO Guidelines, the ARI, or the SARI, in the OECD World Bank); the other, in the process of converting investment to consumption, where the latter is the numeraire (the **accounting price of investment**); or viceversa (the consumption value of public income:  $v$ ).

16/ It has been argued, however, that in very poor countries, high time preference rates are consistent with this very situation of extreme poverty. Yet, as Pearce, Barbier and Markandya argue, "high discount rates are a **cause** of much environmental degradation as individuals opt for (totally understandable) short term measures designed to satisfy immediate wants, and at the expense of sustainable practices... But, in turn, poor prospects arising from environmental degradation actually assist in generating the poverty that 'causes' high discount rates" (1990, p. 31).

17/ The work of Reppeto on Indonesian figures, is a very good case in point.

18/ This is the **micro** approach to its calculation. Some authors have recommended also a **macro** approach: starting from a restricted Cobb-Douglas Production Function, for the whole economy, the marginal productivity of capital could be derived, under certain assumptions, knowing the share of non-labour incomes in national Product, and the inverse of the capital-Output ratio (see, e.g. Mashayekhi, 1980). However, the kind of assumptions required (the applicability of Euler's theorem, among others), makes it highly unreliable, in the context of non-developed countries.

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