

A MULTIPLE ACCOUNT FRAMEWORK FOR COST-BENEFIT ANALYSIS

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Abstract:

The paper presents a spreadsheet-based multiple account approach to cost-benefit analysis which incorporates all the usual concerns of cost-benefit analysts such as shadow-pricing to account for market failure, distribution of net benefits, sensitivity and risk analysis, cost of public funds, and environmental effects. The approach offers a number of advantages to both analysts and decisionmakers, including transparency, a check on internal consistency and a detailed summary of project net benefits disaggregated by stakeholder group.

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INTRODUCTION

Cost-benefit analysis has been accepted as an appropriate tool for appraising proposed public projects since the middle of last century. The theoretical tools are well established, as are the controversies surrounding attempts to measure and compare economic welfare. However recent changes in the economic and technical environments suggest the need for a new approach to implementing the generally accepted theoretical approach.

Cost-benefit analysis was originally conceived to apply to projects undertaken by the public sector. It was seen as the public sector equivalent to the discounted cash flow analysis which would normally be applied to a private sector project proposal. However in recent years the lines between public and private sector projects have become blurred. We see increasing private sector participation in some areas of public sector investment, such as road and rail infrastructure. We see an increasing number of examples of public sector participation in private sector projects, such as major sports events. Large-scale private sector projects are routinely subjected to public benefit tests before they are allowed to proceed. It follows from these developments that cost-benefit analysis needs to encompass the full range of public and private sector concerns if it is to continue to make a useful contribution to public sector decisionmaking.

The technical support available to investment project analysts has improved markedly over the past quarter of a century. The tools have progressed from discount and annuity tables to mechanical and then electronic calculators and more recently to personal computers operating spreadsheets. Most private accounting and investment analysis is spreadsheet based, and it is obvious that public sector analysis needs to take a similar approach, partly for computational convenience, but also to allow the close integration of public and private analyses.

The purpose of this paper is to describe a spreadsheet-based approach¹ to cost-benefit analysis of public projects incorporating a private interest, or private projects incorporating a public interest.

¹ The approach is more fully described in Campbell and Brown (2003)

WHAT INFORMATION DOES THE DECISIONMAKER WANT FROM A COST-BENEFIT ANALYSIS?

Consider a private project in which there is a significant public interest. The public interest may take the form of direct or indirect tax revenues, employment effects, foreign exchange effects, income distribution, or external effects such as pollution. Suppose that a foreign-owned company has applied for permission to proceed with the project, which is to be financed by equity and foreign debt capital, and that it has also asked for various types of concessions, such as a tax holiday, accelerated depreciation, a soft loan, a subsidy, and exemption from some environmental regulations. What would a public sector decisionmaker wish to know about the proposed project?

It can be argued that four different viewpoints from which the project can be appraised are relevant. First, leaving aside considerations of tax treatment and debt financing, is the proposed project efficient from a private market perspective? This perspective, which we term the *project analysis*, is relevant because tax and financial arrangements can sometimes make a “bad” project look “good” or a “good” project look “bad” from either a public or private sector point of view, and we want an independent perspective on efficiency as measured by the market. Second, is the project attractive from the viewpoint of the firm’s shareholders? This perspective, which we term the *private analysis*, is relevant because public sector decisionmakers need an independent appraisal against which they can judge the firm’s case for special treatment. Third, does the project contribute to economic efficiency in the sense that it improves the allocation of scarce resources from a global viewpoint? This perspective, which we call the *efficiency analysis*, is called for because of various types of market failure which result in some market prices not accurately measuring benefit or costs, and because markets for some project inputs or outputs may be missing altogether. Fourth, is the proposed project worthwhile from the viewpoint of the group of people the decisionmaker represents? This perspective, which we term the *referent group analysis*, is called for because the decisionmaker is rarely concerned with the costs and benefits to all parties affected by the project (as summarized by the efficiency analysis). Instead she will be interested in the effects of the project on some subset of those affected (the referent group), usually the residents of a particular province or state, often categorized into a number of ‘stakeholder’ sub-groups.

THE STRUCTURE OF THE ANALYSIS

It will be evident that these four viewpoints are related, and the spreadsheet approach exploits this set of relationships. To illustrate, the spreadsheet analysis starts with the project analysis and summarizes the result in the form of a net benefit stream measured in the form of a cash flow. If we take this cash flow as a starting point, subtract the net financing cash flow, and add or subtract subsidies or taxes where appropriate, the result is the net cash flow to equity holders, which is what the private analysis is designed to reveal. If we take the project analysis and replace observed market prices by shadow-prices where appropriate, and add (subtract) values of non-marketed benefits (costs) we generate the efficiency analysis. Finally, since the efficiency analysis summarizes all the benefits and costs of the project, the referent group net benefits can be selected as a subset of the efficiency net benefits and entered in the fourth and final part of the spreadsheet.

The relationships between the various perspectives on the proposed project offer the possibility of an independent check on the internal consistency of the cost-benefit analysis. Under the traditional approach the analyst would compile a list of all members of the referent group affected by the project: government expenditures and revenues, employment benefits and so on. She would then calculate a money measure of each effect and sum them up in the form of a net benefit stream. Under the proposed approach there is an independent check of whether all relevant groups have been included and whether their benefits and costs have been accurately measured. In the specific example being considered here the only parties with an interest in the project who are not members of the referent group are the foreign equity and debt holders. If we subtract the net cash flows experienced by these two groups from the efficiency net cash flow we will obtain the aggregate referent group net cash flow. If this flow does not correspond in each and every year to the sum of the disaggregated referent group net benefits identified by the analyst an error has been made, and it should be relatively easy to correct through detailed comparison of the two measures of aggregate referent group net benefits.

AN ILLUSTRATION

Consider the following simple example² which serves to illustrate the key principles of this multiple account approach:

Suppose that a foreign company proposed to invest \$100 in a project which will produce 10 gadgets per year for a period of 5 years. The gadgets will sell for \$10 each. To produce the gadgets the firm will have to hire 20 units of labor per year at a wage of \$3 per unit. The project is located in an area of high unemployment and the opportunity cost of labor is estimated to be \$2 per unit. The firm will pay tax at a rate of 25% on its operating profit (defined here as its total revenue less its labor costs). There are no other costs or allowances, such as depreciation allowances, and the project has no effect on the market price of any input or output.

Figure 1 illustrates the structure of the spreadsheet. The project data, consisting of the capital cost, the output and input flows, the prices and shadow-prices, and the tax rate are entered in Section 1. In Section 2 the project benefit-cost analysis is conducted: the flows of costs and benefits, valued at market prices, are calculated for each of the five years of the project's life, using Section 1 as the source of the data. A net benefit stream, represented by a net cash flow, summarizes the effects of the project, and net present values (NPVs) at a range of discount rates, and an internal rate of return (IRR) are calculated. In Section 3, the private cost-benefit analysis is conducted, again with reference to the data in Section 1. In this simple example, the benefits of the project to the private firm consist of the after-tax returns. Again the performance of the project is summarized in the form of a net cash flow, and NPVs and the IRR are calculated. In Section 4 the efficiency cost-benefit analysis is conducted which involves using shadow-prices where appropriate.

In the simple example, the only shadow-price required is that of labor, which is \$2 per unit. As in Sections 2 and 3 of the spreadsheet the net benefit stream is calculated from the data in Section 1 and expressed in the form of a net cash flow. NPV is calculated for the chosen range of discount rates and an IRR is calculated.

Section 5 contains the referent group cost-benefit analysis. In this case it is assumed that the referent group consists of the government and workers of the host country, and does not include the foreign equity holders of the private firm. The first line of the referent group

² This problem and the solution are taken from Campbell and Brown (2003), Chapter 1.

Figure 1: Spreadsheet Layout of the Cost Benefit Analysis

Section 1: Project Data					
Capital Cost	\$100	Product Price	\$10	Tax Rate	25%
Output Flow	10	Wage	\$3	Dis. Rate	5%
Labour Input	20	Shadow Wage	\$2	Dis. rate	10%
		Year			
	0	1	2	3	4
Section 2: Project Cost-Benefit Analysis					
Benefits		100	100	100	100
Operating Costs		-60	-60	-60	-60
Capital Costs	-100				
Net Benefit	-100	40	40	40	40
NPV@5% = \$73.18		NPV@10% = \$51.63		IRR = 29%	
Section 3: Private Cost-Benefit Analysis					
Benefits		100	100	100	100
Operating Costs		-60	-60	-60	-60
Capital Costs	-100				
Taxes		-10	-10	-10	-10
Net Benefit	-100	30	30	30	30
NPV@5% = \$29.88		NPV@10% = \$13.72		IRR = 15%	
Section 4: Efficiency Cost-Benefit Analysis					
Benefits		100	100	100	100
Operating Costs		-40	-40	-40	-40
Capital Costs	-100				
Net Benefit	-100	60	60	60	60
NPV@5% = \$159.77		NPV@10% = \$127.45		IRR = 53%	
Section 5: Referent Group Cost-Benefit Analysis					
Referent Group Aggregate Net Benefits					
	0	30	30	30	30
Referent Group Net Benefit Allocation					
Govt. (taxes)		10	10	10	10
Labour (rent)		20	20	20	20
Total		30	30	30	30
Net Present Values		5%	10%		
Govt.		\$43.29	\$37.91		
Labour		\$86.59	\$75.82		
Total		\$129.88	\$113.72		

analysis is simply the difference between the efficiency net benefit stream and the non-referent group net benefit stream, which in this example is the private net benefit stream. While this calculation tells us the aggregate net benefits to the referent group, we want some information about the distribution of these benefits. The two groups of beneficiaries are the government and labor and the net benefit streams accruing to each are entered in the referent group net benefit allocation account: tax revenues to government, and rent to labor, calculated as wages in excess of those which could be earned in the alternative activity. When these two benefit streams are added we get an alternative measure of the aggregate referent group net benefit stream.

If the referent group net benefit measures obtained by the two methods of calculation are inconsistent in any year, an error has occurred, perhaps in shadow-pricing or in identifying or measuring benefits or costs to referent group members. Once any discrepancy has been accounted for and corrected, a summary measure of the performance of the project from the

viewpoint of the referent group can be prepared in the form of an NPV, and NPVs can be calculated for subsets of the referent group, such as government, labor, farmers, and so on.

Because project data are entered in Section 1 of the spreadsheet only, we can use our model to perform sensitivity analyses simply by changing one cell entry in the data section. For example, suppose the tax rate were increased to 40%, would there still be sufficient inducement to the foreign firm to proceed with the investment, while providing a reasonable net benefit stream to the referent group? To answer this question, all we need do is change the tax rate cell in Section 1 to 40% and review the new set of results, in particular the new value of the firm's IRR.

CLASSIFICATION OF PROJECT NET BENEFITS

It will be evident from the above example that there are two important distinctions in classifying project net benefits: first, the distinction between those net benefits which are measured (or *captured*) by market prices and those which are not; and second, the distinction between referent and non-referent group net benefits.

The project analysis evaluates the project's net benefits using market prices, but in some cases these do not reflect marginal benefits or marginal costs of project outputs or inputs, and in other cases market prices do not exist. The result is that the project analysis may fail to measure a wide range of benefits or costs, including, for example, employment benefits, some tax revenue effects, and environmental costs. The difference between the net benefits calculated in the project analysis from those identified by the efficiency analysis measures the extent to which market prices fail to capture the project's benefits or costs.

The distinction between referent and non-referent group net benefits is more straightforward. The cost-benefit analysis has been commissioned as an input to the decisionmaking process governing the project. The decisionmaker represents a constituency, usually a national, state or regional population, and possibly the most important question to be addressed by the analysis is how that group (the referent group) will be affected if the project proceeds.

We can illustrate these two types of distinctions by means of the four categories of project net benefits illustrated by the four cells in Figure 2. This figure also helps to bring out the relationships among the

project, private, efficiency and referent group net benefit accounts in the spreadsheet framework illustrated by Figure 1. For example, the project analysis is summarized by cells A+B, with the private analysis being a subset of this amount determined by the tax and financial arrangements concerning the project. The referent group analysis is summarized by cells A+C, and the efficiency analysis by cells A+B+C+D. The check on internal consistency is provided by ensuring that the various referent group net benefits sum to an amount represented by cells A+B+C+D less cells B+D.

Figure 2: Classification of Net Benefits

	Net Benefits Accruing to:	
	Referent Group	Non-Referent Group
Net Benefits Measured by Market Prices	A	B
Net Benefits <u>not</u> Measured by Market Prices	C	D

When we apply this fourfold classification to the spreadsheet example in Figure 1 we get the following results (using a 10% discount rate): cells A+B sum to \$51.63 (the project analysis); project net benefits are divided between cell A (\$37.91 in tax revenues) and cell B (\$13.72 return to foreign equity holders); cell C consists of \$75.82 worth of referent group members' employment benefits that were not accounted for because of the use of the market wage to cost labor in the project analysis; and cell D is empty in this particular example. The sum of cells A+B+C+D equals the efficiency net benefit which is \$127.45. It would be easy to vary the example to ensure that cell D contained a net benefit or cost: for example, the project could hire foreign workers (not members of the referent group) on favorable contracts that resulted in employment benefits; or the project could generate trans-boundary pollution that imposed costs on neighboring countries (again not members of the referent group).

SOME IMPLICATIONS OF THE MODEL

This section of the paper describes how some issues which are commonly encountered in undertaking cost-benefit analyses are handled within the framework described above.

Consumer and Producer Surplus

When a project involves quantities of non-tradeable outputs or inputs which are large relative to total quantity demanded or supplied in the local market, market prices may change as a result of undertaking the project. This presents no problem for the project and private

analyses as these are always conducted using the market prices which will actually be experienced if the project goes ahead (ie. post-project prices). Much of the extensive economic literature on consumer and producer surplus³ concerns the valuation of project outputs or inputs in the efficiency analysis. At the risk of over-simplification, it can be argued that, where market prices are the appropriate measures, project outputs and inputs should be valued at an average of the pre- and post-project prices.

The effect of this procedure in the proposed framework, compared with a situation in which market prices are assumed not to change as a result of the project, is to lower the measure of the efficiency net benefit of the project - output prices are lower and input prices higher. However the effect on the referent group net benefit depends upon the definition of the referent group. In the examples considered above the private firm was assumed not to be part of the referent group. Since project outputs (inputs) are valued at the lower (higher) post-project prices, the private net benefit falls by more than the efficiency net benefit and when, in this example, private net benefit is subtracted from the efficiency net benefit to calculate referent group net benefit, the referent group net benefit actually rises. The reason for the rise is obvious: members of the referent group buy outputs from the project at the lower post-project prices, and supply inputs at the higher post-project prices.

The above discussion concerns the valuation of project outputs and inputs only. However when market prices change they change for the total quantity of output or input traded in the market. These changes are transfers which net out of the efficiency analysis: a consumer gains through paying a lower price, a firm loses through receiving a lower price; a worker gains through receiving a higher wage, a firm loses through having to pay a higher wage. However these transfers, occurring elsewhere in the economy, may be occurring between referent and non-referent group members, such as foreign firms. It can be argued that such economy-wide effects are outside the scope of the project cost-benefit analysis, and are really the subject of an economic impact analysis.

An important exception to the above conclusion is the case in which the change in input or output price reflects a change in cost. For example, a bridge may reduce the cost of a trip between two locations and generate additional traffic as a result. While the extra trips generated by the lower unit cost can be valued in the way discussed above, there is also a benefit in the form of a cost saving on each existing trip. In other words, the fall in price of a

³ See for example Willig (1976).

trip generates a benefit to consumers that is not offset by a cost to producers, and this benefit appears in both the efficiency and referent group analysis.

The Foreign Exchange Premium

Cost-benefit analysts working on proposed projects in developing economies are familiar with the situation of a domestic currency which is over-valued in terms of its rate of exchange with hard currencies such as the US dollar. The over-valuation may result from a fixed exchange rate or from a significant program of import tariffs and export subsidies. The over-valuation produces a divergence between the value of foreign exchange at the official exchange rate (OER) and its marginal value to the economy (referred to as the shadow-exchange rate (SER)); this divergence is usually referred to as the foreign exchange premium (FEP).

Because there are effectively two exchange rates (the OER and the SER) there are effectively two sets of prices which could be used to value project outputs and inputs – world prices and domestic prices. There have traditionally been two views as to which set of prices should be used in project appraisal: the UNIDO approach⁴ argues for domestic prices and the OECD approach⁵ argues for world prices. However it is generally agreed that while the two approaches will obviously produce different estimates of project net present value, a project accepted under the UNIDO approach will always be accepted under the OECD approach, and *vice versa*.

The cost-benefit framework proposed in this paper can handle either approach. The UNIDO approach is implemented by using the SER to convert values of traded commodities from foreign to domestic currency, and shadow-pricing non-traded commodities in the usual way to account for distortions in the domestic economy. The OECD approach is implemented by using the OER to convert values of traded commodities from foreign to domestic currency, and shadow-pricing non-traded commodities to account for the discrepancy between values at domestic and world prices, as well as for any distortions in the domestic economy.

One consideration favoring the use of the UNIDO approach within the cost-benefit analysis framework described here is the advantage of valuing referent group net benefits at domestic

⁴ UNIDO (1972).

⁵ Little and Mirrlees (1974).

prices, so that they correspond to the values actually experienced by referent group members in the domestic economy. Applying the UNIDO approach to a project which is a net earner of foreign exchange will increase the efficiency net benefit (as compared with making no adjustment to account for the foreign exchange premium) because the SER in terms of domestic currency per US dollar is higher than the OER. Whether shadow-pricing foreign exchange makes a difference to the referent group net benefits depends on which group is able to appropriate the FEP generated by the project: at one extreme, foreign firms may be able to appropriate it through trading in the currency black market; and at the other extreme, if all foreign currency transactions are ultimately channeled through the domestic central bank it will appropriate the FEP in the form of currency trading profits.

Risk and Uncertainty

It will be recalled that, in the simple example described earlier in the paper, project data were entered in the spreadsheet only once, in Section 1. All data contained in Sections 2 to 5, which calculate project, private, efficiency and referent group net benefits respectively, are generated by references to cells contained in Section 1. Apart from facilitating transparency of assumptions underlying the analysis, following this convention greatly assists assessing the impact of risk and uncertainty.

Uncertainty about prices or output and input flows can be modeled by calculating the sensitivity of the proposed project's NPV to changes in the assumptions made about the values of these variables. These calculations are done simply by changing the value recorded in Section 1 of the spreadsheet and observing the effect on the NPVs or IRRs reported in subsequent Sections. Threshold values can be easily calculated for critical variables such as output price or exchange rate in the same manner.

A more formal analysis can be conducted by means of a Monte Carlo simulation⁶ which calculates a probability distribution of the proposed project's NPV. Variables in Section 1 of the spreadsheet are assigned probability distributions, or joint probability distributions where appropriate, and the NPV is calculated, say, 5000 times using values sampled at random from these distributions. The 5000 NPV results are then arrayed in the form of a probability density function and summary statistics such as mean and variance can be calculated. These

⁶ A useful program is @RISK[®] (Palisade) which can be installed as an add-in to the EXCEL[®] (Microsoft) spreadsheet.

results provide the basic information which the decisionmaker needs to assess the cost of risk associated with the project.

Cost of Public Funds

Studies of the cost of public funds in a variety of OECD countries⁷ suggest that collecting an extra dollar of tax revenue actually costs the private sector something in the order of \$1.20 to \$1.30. If undertaking a proposed project will involve a net outflow of public funds, the deadweight loss associated with collecting these funds should be attributed as a cost to the project. Similarly, if the project involves a net inflow of public funds it should be credited with the deadweight loss which would have been incurred if those funds had been raised in the usual way.

Because the disaggregated referent group net benefit account includes a series of rows summarizing the implications of the proposed project for public revenues and expenditures, it is a relatively easy matter to incorporate the shadow-price of public funds in the cost-benefit analysis. The simplest way to do this is to generate a row in the referent group net benefit account summarizing the net outflow (inflow) of public funds, multiply this row by the public funds shadow-price minus unity, and include the resulting row as a cost (benefit) to the economy in general. Since the cost (benefit) results from increased (decreased) distortion of private sector resource allocation, relative to the efficient allocation, it is widely dispersed in the economy and could only be attributed to specific subsets of the referent group after a great deal of research. The fall (rise) of referent group net benefits is matched by an equivalent fall (rise) in efficiency net benefits calculated in the same way.

Income Distribution

The disaggregated referent group net benefit account summarizes the impact of the proposed project on income distribution across the various stakeholder sub-groups identified in the referent group account. The decisionmaker can take account of this either informally, through an exercise of judgement, or formally through application of a set of income distribution weights. In the later case, an additional Section of the spreadsheet should be constructed because the adding-up property of the four original Sections will no longer hold: for example,

⁷ See for example Campbell and Bond (1997).

weighted referent group net benefits plus the non-referent group net benefits will no longer necessarily sum to the efficiency net benefits.

Trade-offs among net benefits accruing to various subsets of the referent group can be established by varying some of the project data in Section 1 of the spreadsheet. For example, tax or subsidy rates could be varied to establish the trade-offs between taxpayers and specific referent group subsets. These trade-offs indicate the cost to taxpayers of making some groups in the economy better off, and, where income redistribution is a major objective, this kind of information immediately raises the question of whether there is a cheaper alternative to the project.

There will not always be an unambiguous definition of the composition of the referent group. For instance, projects often involve multiple levels of government, each with different perspectives on which components of the aggregate net benefits stream are most relevant. What appears as a cost to one level of government can appear as a benefit to another. Here a disaggregated referent group account is most useful as it enables the analyst readily to identify the net benefit stream relevant to each party to the decision, and, through sensitivity analysis, to compute the magnitude of any trade-offs under alternative assumptions or policy scenarios affecting the project.

Similarly, in participatory decisionmaking contexts where there are competing objectives and interests among the different stakeholder groups, a disaggregated referent group analysis can play a very useful role in informing the deliberations among the decisionmakers. Used in this way cost-benefit analysis becomes similar to a multiple-objective decision support system (MODSS) where there is no single bottom-line, but rather, a multiple set of bottom-lines, each corresponding to the net benefits from the perspective of the various stakeholder groups affected by the project. As opposed to conventional cost-benefit analysis with a single bottom-line, this approach allows for greater transparency in the modeling of alternative project or policy scenarios, where the gains and losses incurred by each stakeholder group would be readily quantifiable in the disaggregated referent group account.

Non-marketed Inputs or Outputs

It has become more or less a standard to summarize the environmental consequences of a large project in the form of an Environmental Impact Statement (EIS) which is separate from

the cost-benefit analysis. A disadvantage of this approach is that the dollar net benefits identified by the cost-benefit analysis are not commensurate with the air and water quality and other measures established by the EIS. In consequence the environmental costs or benefits of the project are traded-off against the other costs and benefits through some informal process. However great advances have recently been made⁸ in the valuation of non-marketed commodities and these offer the possibility of integrating an increasing proportion of the environmental or other non-marketed effects of projects into the cost-benefit framework.

Once dollar measures of these costs and benefits are available it is an easy matter to incorporate them in the framework proposed in this paper. Since they are not marketed, environmental costs and benefits are not relevant to the project and private analyses (represented by cells A and B in Figure 2), but they can readily be incorporated as a series of additional rows in the efficiency analysis (in cells C and D in Figure 2). In the case of a project with significant environmental costs, for example, the efficiency net benefit will be reduced and this may be reflected in an equivalent fall in the referent group net benefit (in cell C in Figure 2). However, in the case of a project with a global impact on the environment, through climate change for example, the referent group, if narrowly defined, may experience only a small proportion of the total environmental cost, with most of the impact being on the non-referent group stakeholders (in cell D in Figure 2).

SUMMARY

This paper has presented a spreadsheet-based multiple account approach to cost-benefit analysis which incorporates all the usual concerns of cost-benefit analysts such as market failure, distribution of net benefits, risk, cost of public funds, and environmental effects. The approach provides a summary of project net benefits disaggregated by stakeholder group. For example, it reports the net benefits to private and public participants in the project, to local, state and national levels of government, or to sub-groups in society such as rural residents, pensioners, and native peoples. It is designed to facilitate sensitivity analysis so that trade-offs among stakeholder groups can readily be identified. While it emphasizes social

⁸ See for example Cummings, Brookshire and Schulze (1986); Mitchell and Carson (1989); Hanley and Spash (1993); Garrod and Willis (1999).

accounting more than the traditional concerns of cost-benefit analysis, such as consumer and producer surplus measurement, it can readily incorporate these concerns where appropriate.

The approach offers advantages to both the decisionmaker and the analyst. From the analyst's viewpoint the spreadsheet framework is a template which can be used for each project. The progression from project and private analysis through to efficiency and referent group analysis provides a framework for the information-acquiring process, starting with the analysis based on readily available market prices, and proceeding to the more contentious areas of shadow-pricing and non-market valuation. The approach provides a check on the internal consistency of the analysis: given the information provided in the first section of the spreadsheet, have all the benefits and costs been correctly measured and attributed?

From the decisionmaker's viewpoint the approach provides uniformity, transparency, quality assurance, and the detailed information required to come to a decision. If all cost-benefit analyses which cross the decisionmaker's desk follow the template, assessing any particular analysis is made easier. The data section of the spreadsheet (Section 1 in Figure 1) reports all the quantities, market prices and shadow-prices used in the analysis, together with the assumptions made about taxes and finance; if any of these seems incorrect it is a simple matter to determine the sensitivity of the results to changes in any of these variables. Having satisfied herself that the analysis is based on the appropriate data, the check on internal consistency assures the decisionmaker that it has been correctly carried out. The disaggregated referent group net benefit account then provides the kind of information that the political process requires.

References

- Campbell, H.F. and Bond, K.A. (1997). The Cost of Public Funds in Australia, *The Economic Record* 73(220): 22-34
- Campbell, H.F. and Brown R.P.C. (2003). *Benefit-Cost Analysis: financial and economic appraisal using spreadsheets*. Melbourne: Cambridge University Press.
- Cummings, R., Brookshire, D. and Schulze W.D. (eds) (1986). *Valuing Environmental Goods*. Rowman and Allanheld.
- Garrod, G. and Willis, G. (1999). *Economic Valuation and the Environment*. Cheltenham: Edward Elgar.
- Hanley, N. and Spash C.L. (1993). *Cost-Benefit Analysis and the Environment*. Aldershot: Edward Elgar.
- Little, I.M.D. and Mirrlees J.A. (1974). *Project Appraisal and Planning for Developing Countries*. London: Heinemann.
- Mitchell, R.C. and Carson R.T. (1989). *Using Surveys to Value Public Goods: the Contingent Valuation Method*. Resources for the Future: Washington DC.
- UNIDO (1972). *Guidelines for Project Evaluation*. New York: United Nations.
- Willig, R.D. (1976). Consumer's Surplus without Apology. *American Economic Review* 66(4): 589-597.