

## Economic Appraisal 4

### 1. Identification and Evaluation of Costs and Benefits: Green Book Recommended Procedure

We begin this Topic by laying out the standard procedure for doing these activities as given in the Green Book. The following box lays this out exactly as given in the Green Book (Section 2.9, page 5).

Each option is then appraised by establishing a Base Case<sup>1</sup>. This is the best estimate of its costs and benefits. These estimates can then be adjusted by considering different scenarios, or the option's sensitivity to changes can be modelled by changing key variables. More fully, the appraisal may develop as follows:

- Identify and value the costs of each option.
- Identify and value the benefits of each option.
- If required, adjust the valued costs and benefits for:
  - Distributional impacts (the effects of proposals on different sections of society);
  - Relative price movements.
- Adjust for the timing of the incidence of costs and benefits by discounting them, to obtain their present values.
- If necessary, adjust for material differences in tax between options.
- Adjust for risk and optimism to provide the Base Case, and consider the impacts of changes in key variables and of different future scenarios on the Base Case.
- Consider unvalued impacts (both costs and benefits), using weighting and scoring techniques if appropriate.

1. The term 'Base Case' is sometimes used to refer to the 'do minimum' option, but it is not used in this way in the Green Book.

In this Topic we take you through these steps. However,

- discounting to present values is considered in more depth in Topic 5
- adjusting valued costs and benefits for distributional impacts is a process that is returned to later and examined in more depth in Topic 7
- adjustments for risk (and uncertainty) and optimism are considered further and in more depth in Topic 8.

### 2. Changes in Costs and Benefits: Some Preliminaries

We have seen in the previous three topics that the starting point for economic appraisal is the identification of a need for some intervention: a rationale that will, implicitly or explicitly, generate an **objective** (or ultimate goal) that is being sought from the intervention. Without a clear and convincing rationale, an intervention cannot be justified.

Usually there will be more than one way in which any particular objective can be reached. Each of these ways constitutes an **option**. The full set of options to address some

overall objective may be very large indeed; to make headway it will be sensible to define a shortlist of options for detailed examination.

At the outset of the appraisal process, which of these (short-listed) options is best is not known.<sup>1</sup> If scarce resources are to be used efficiently, however, it is imperative that the best option is selected. How one can decide what it is that constitutes or defines the 'best' option is going to be considered in the next Topic of this course. But logically prior to any choice of best option must be a process of laying out in a systematic way the benefits and costs of each available option. This corresponds to the first two bullet-pointed steps in the Green Book's recommended procedure reproduced on the previous page. Without reliable and robust information about costs and benefits, no choice of best way of intervening is possible. Nor, more importantly, would it be possible to say whether even the best of the available options is actually worth doing.

This lesson provides some guidance about how one can carry out the process of systematically identifying and evaluating the costs and benefits of each short-listed option. The first step in option appraisal is to establish the counterfactual; this is considered on the next page. That is followed by some discussion of the **identification** of costs and benefits of an option, relative to the counterfactual. We shall then turn to the **evaluation** of costs and benefits.

1. We must also allow for the possibility that the best response may not be the selection of one single option but instead will be a combination of options. This complication will be considered in Topic 5.

### 3. Setting out the shortlist of options and establishing the counterfactual

In order to proceed, let us assume that we have a short-list of options from which a selection must be made. For expositional simplicity, we suppose that there are three options, called X, Y, and Z. In no way should this be read as suggesting that 3 is an optimal number of options. And, of course, the labels X, Y and Z are entirely arbitrary.

Of absolute importance (for without it economic appraisal will be largely meaningless) is that one of the options to be considered **MUST** be the 'counterfactual' option. The term counterfactual is used here to reflect the key point that the costs and benefits of any intervention option must be measured relative to something: that something is the counterfactual.

The counterfactual is also sometimes referred to as the "Baseline" or "Reference" option, as it is the reference case or baseline relative to which each other option is assessed. It is best, however, to avoid using 'baseline' as a synonym for counterfactual, as this risks confusion with the phrase 'Base case'. As explained later, this carries an entirely different meaning.

The counterfactual need not - and often will not - be a state of affairs in which nothing is being done by way of intervention. Rather, the counterfactual will usually describe a 'Business as Usual' state of affairs. For example, think about

some market in which there has hitherto been very substantial regulatory intervention. Suppose that concerns have been expressed that the regulation in question has been doing more harm than good. An alternative 'option' would be to deregulate the market, perhaps accompanied by measures that seek to intensify competition in or for the market. In this example, it would be appropriate to treat the existing regulatory intervention state as the counterfactual.

Note that the Green Book explicitly refers to the requirement that one shortlisted option must always be the "*Do Minimum*" option. In insisting on this, the Green Book authors clearly have in mind that the *Do Minimum* option is the same thing as the Counterfactual in the sense being used here. Provided that *Do Minimum* is interpreted as meaning **changing things as little as possible from what they would otherwise be** (rather than as having the far more ambiguous meaning of 'intervening in the most minimal way possible'), this is in accord with our use of the term counterfactual.

However, for clarity of thinking, I strongly recommend that you use the term *Counterfactual* (or *Reference*) as label for the option against which the other short-listed options are being appraised, instead of thinking about it as the *Do Minimum* option.

One other point about the counterfactual option warrants mentioning: it will often be necessary to specify the counterfactual in terms of a reference case **time path**. Discussions about climate change policy illustrate this. The counterfactual option is usually specified as one in which policy makers continue with existing policy measures (and policy instrument settings) over some suitable span of time ahead (such as until 2020 or 2100), and make no changes to those measures other than changes to which they have already pre-committed (through international agreements, perhaps).

Of course, where the counterfactual is specified as a time path then so must be the options that are being appraised relative to it. Moreover, doing so implies that it will be necessary to estimate time paths of **expected outcomes** over some relevant time horizon for both counterfactual and other short-listed options, as without doing so changes in costs and benefits cannot be identified.

## Looking ahead

In what follows, we shall treat Option X as being the counterfactual. Thus Option X is the reference case against which Y and Z are being appraised. In effect, we are treating X as the default, that which will happen if neither Y nor Z is selected.

Our task now is to identify and evaluate the benefits and costs that would result if we were to

1. Select Option Y rather than X
2. Select Option Z rather than X

Once this is done, we will be in a position to determine whether X, or Y or Z should be chosen.

## 4. Identifying Costs and Benefits: Introductory Remarks

The discussion to date in this lesson has been framed as an option appraisal exercise in which we are to select among options X, Y, and Z, where X has been defined as the counterfactual or reference case option. We continue with this framing and for simplicity assume that X, Y and Z are mutually exclusive and are proportionally scalable (so that each can be done to whatever scale is desired). These assumptions will be relaxed later.

Always having the counterfactual as one of the options being appraised serves to simplify our calculations and so make the task more manageable than it would be otherwise. Instead of attempting to measure the **level** of welfare under each of X, Y and Z, one may normalise on the counterfactual, X, and appraise options Y and Z relative to X. This is done by estimating the welfare **changes** that would be involved in moving from X to Y and from X to Z. Put another way, what we are doing in economic appraisal is identifying and measuring the incremental costs and benefits of an intervention option, relative to the counterfactual.

In the final analysis, the choice between X, Y and Z will be determined by impacts on individual utilities and so on social welfare. (Recall from the notion of a social welfare function that impacts on individuals are - at least in principle - expressed in terms of utility changes; impacts on society as a whole are expressed in terms of changes in social welfare, where social welfare is some function of individual utilities). Impacts may be ones that are utility and/or welfare enhancing or ones that are utility and/or welfare reducing.

We should attempt to forecast all of the consequences of going ahead with the intervention (relative to the reference case) for each and every affected individual in each year of the project's total lifetime. Our task is to identify and then evaluate all those aspects of Y and Z that could, relative to X, either increase or decrease welfare. Note that the word 'impact' here is being used here in a general way - to refer to anything that has an effect on welfare.

## 5. Setting out the incremental costs of an intervention option

In carrying out an economic appraisal, anything that directly or indirectly increases or decreases economic welfare should be included as a benefit or cost, as appropriate. In standard welfare economic texts, it is usual to define a benefit as something that increases welfare and a cost as something that reduces welfare.

DFID reporting conventions, however, vary from this in one important way. Costs comprise the total real economic costs of the **inputs** being used and **activities** undertaken in the intervention being appraised. They should **not** include adverse **outcomes** of the intervention; where such adverse outcomes occur, they are treated as negative benefits (and so be deducted from the stream of positive benefits).

Treating adverse impacts of a project as negative benefits, rather than as project costs, does not alter the NPV or the IRR of a project. However, it may alter the project's Benefit to Cost ratio (BCR). We shall explore this in detail later while discussing Performance Measures. To illustrate the points made above, an [Excel file is attached here](#) which compares the consequences of treating an adverse impact as a cost with treating it as a negative benefit.

The DFID convention of restricting costs to include only the real economic costs of the **inputs** being used and **activities** undertaken in the intervention being appraised implies that most of the items that will count as project costs will in the form of capital and recurrent (or operational) costs.

For each option, therefore, one should set out in tabular form (or in a spreadsheet) the estimated capital and recurrent/operational costs. Each of these items of cost should be identified for each year of the project, programme or policy lifetime. (That lifetime should cover the whole span of years for which the project (or programme or policy) has any significant welfare impacts, adverse or beneficial. Of course, the cost entries for many of these years may be zero.

From standard welfare economics theory, we know that costs should be expressed in terms of relevant opportunity costs. Thus an important part of the appraisal process is exploration of what opportunities may exist for the resources being used in the intervention option. We shall have more to say later on this matter when discussing the **evaluation** of costs and benefits. Suffice to say at the moment that it is opportunity costs that should appear in an economic appraisal - and that opportunity costs will not necessarily coincide with financial or market-price based costs.

## Affordability issues

Whilst EA is principally about welfare impacts on society, we must also be cognizant of the existence of government budget constraints, programme budgets, collaborative projects with other donor agencies, and requirements that public funding allocations can be shown to generate value for money.

With these considerations in mind, and to allow for appropriate managerial accounting processes, it will also be necessary to identify (for each of the shortlisted options) the magnitude and timing of the nominal values of capital and operational costs incurred by DFID itself and by the various other parties involved in funding the activity. We shall have more to say on this later on the page that deals with 'affordability'.

## 6. Setting out the incremental benefits of an intervention option

Remember that DFID conventions allow for both negative and positive benefits. A negative benefit is an adverse impact on well-being that results from an intervention (other than one associated with the opportunity costs of the capital and operating expenses of the project itself).

Thus the 'benefits' to be included in an economic appraisal (EA) consist of both positive benefits and negative benefits, where the latter consists of adverse impacts on individual utilities. For convenience, we shall use the word 'benefit' (and sometimes the word 'impact') to refer to both negative and positive benefits.

In the initial stage of identifying impacts, the metric in which any particular type of benefit should be measured and recorded is one in terms of units in which the impact is directly expressed: lives saved, infections avoided, etc.

Each of the following is important:

1. We must identify ALL welfare relevant impacts.
2. Each impact should be assigned to a well-defined categories of benefit.
3. Impacts should also be mapped to specific categories of affected individuals, to allow for possible use later of distributional weights.
4. Impacts should be given time attributions, so that we know in which year or years any particular impacts occurs.

Thus we are seeking to tabulate information about benefits (or impacts) in a way which provides each of the above three kinds of information. The following graphic (a screenshot from an Excel workbook used for the Discussion Forum for this topic) does this (roughly speaking). Here we have an HIV/AIDS reduction project. The sheet below is the data input page for the remainder of the workbook. It lists three categories of costs and three categories of benefit. We assume that these six items comprise the full set of impacts (plus capital and operating costs) of the project. Use is made of Excel cell comments to explain what categories of individuals are affected by each cost or benefit item. (In some cases, the comments show that the appraiser does not know this information.) A set of distribution weights are also specified on the basis of judgements made by the appraisal team, the motivation for which is again given in annotated comments. Later sheets in this workbook go on to carry out the project appraisal (where the counterfactual is implicitly a "Business as Usual" state in which no policy interventions other than those already taking place occur) and all costs and benefits shown here are measured relative to that counterfactual.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
1																		
2		<b>Basic Information</b>																
3			QUANTITY	UNITS	Description													
4						Capital costs of £100m, paid for in equal shares by DFID and WHO												
5																		
6			C1	60	£m	Capital costs												
7			C2	7	£m	Operations costs												
8																		
9			gC2	0.05	#	Annual growth of C2												
10																		
11																		
12																		
13			C3	10	£m	Employee costs												
14																		
15																		
16				4000	#	No of employees												
17				5000	£	Nominal wage (£ pa) of each employee												
18				2500	£	Shadow wage (£ pa) of each employee												
19				0.5	#	Scaling factor to arrive at shadow wage												
20																		
21																		
22																		
23																		
24																		
25																		
26																		
27			<b>Benefits</b>															
28			B1	41	#	E(lives saved)/pa												
29			gB1	0.2	#	B1 annual growth rate												
30				0.05	£m	Value of a statistical life (VSL)												
31																		
32																		
33																		
34			B2	22	£m	Reduced hospital/health care costs												
35			gB2	0.01	#	B2 annual growth rate												
36																		
37			B3	12	£m	Reduction in estimated costs of crime												
38			gB3	0.05	#	B3 annual growth												
39																		
40						# denotes a number												
41						£ denotes £1												
42						£m denotes £1 million												
43																		
44			r	0.05	#	Social discount rate												

The worksheet of that constitutes this particular part of an Excel workbook that goes on to obtain the NPV of this project [is available here](#), and is also linked to [the Discussion Forum](#)

[for this Topic](#). At the end of this Topic, you should go to that Discussion Forum and carry out the tasks indicated there.

Three other important points should be made before we move on:

1. **All** implied welfare changes should be considered, **both direct and indirect**. So as well as taking into account the direct effects of interventions, the wider effects on other areas of the economy or society should also be considered. In all cases, these wider effects should be clearly described and considered. This might entail modelling complex linked processes. (See Topic 6 for a full examination of how one might estimate indirect, as opposed to direct, impacts).
2. The full set of welfare impacts may include external impacts such as environmental costs or benefits. The Treasury Green Book is very clear on this matter: "*Wider social and environmental costs and benefits for which there is no market price also need to be brought into any assessment. They will often be more difficult to assess but are often important and need to be included in the appraisal. They should not be ignored simply because they cannot easily be costed.*" These matters are discussed at more length later in this Topic.
3. One must take great care to avoid 'double-counting'. (This is also examined in Topic 6, and so we do not pursue it here.)

## 7. Affordability

Economic Appraisal (EA) is principally aimed at assessing the **value of a project (or a project option) to society as a whole**. If the total discounted value of benefits exceeds the total discounted value of costs (when all costs and benefits are valued at appropriate shadow prices) then the level of social welfare will be higher with the project than without it, and so society as a whole benefits from the project.

A separate component of any EA concerns affordability. This arises from the existence of government budget constraints. Public agencies have resource budgets and have to work within those. So the affordability of a project is of importance in itself, and will entail estimating likely resource budgets requirements, and detailed statements of how proposals will be funded. This information will also be vital for ex post evaluation of projects, programmes and policies.

Green Book guidance about the treatment of costs is somewhat confusing, as that document does not distinguish as clearly as it should do between

- (a) identification and valuation of costs for economic appraisal (welfare-relevant purposes, and
- (b) identification and valuation of costs for managerial accounting (programme budget management) purposes.

The remarks on this page refer to the latter.

For each option, it will be useful to set out in tabular form (or in a spreadsheet) estimated capital and recurrent/operational costs. These should be mapped out for each year of the project, programme or policy lifetime. Contributions to costs should be separately identified for:

- DFID
- Client country government
- Each development partner
- Private organisations and individuals

The UK Treasury's Green Book provides further detailed guidance on standard procedures for estimating costs for management accounting purposes. In particular, Chapter 6 of the Green Book provides information on resource budgets and the other accounting requirements of appraisals. As an example, we report the following Green Book extract:

For management accounting purposes, and for sensitivity analysis, it can be useful to distinguish between fixed, variable, semi-variable and step costs (the definitions below are taken from Drury (1998): Management and Cost Accounting, VNR International, London):

- Fixed costs remain constant over wide ranges of activity for a specified time period (such as an office building);
- Variable costs vary according to the volume of activity (external training costs, for example, varying with the number of trainees);
- Semi-variable costs include both a fixed and variable component (maintenance is an example, where there is usually a set planned programme, and a responsive regime whose costs vary in proportion to activity, i.e. the number of call-outs); and,
- Semi-fixed, or step costs, are fixed for a given level of activity but they eventually increase by a given amount at some critical point (after telephone call volumes reach a certain level, a new call centre may be required).

## Final Remarks

Cashflows and 'full resource costs' are important in the managerial accounting part of any appraisal process, as they inform assessment of the affordability of a proposal. However, it is important to be aware that they do not provide (nor attempt to provide) the **opportunity cost** of the resources being used. Thus they cannot be used to understand the wider costs and benefits of proposals (the welfare-relevant aspects).

## 8. Valuation of the Costs and Benefits of Options, and the notion of Shadow Pricing

Earlier parts of this Topic have been concerned with **identifying** costs and benefits. This page (and others to follow) is concerned with **valuing** those costs and benefits.

It is a basic assumption of economic appraisal (EA) that all of the consequences for individuals can be expressed in terms of **monetary gains and losses**. To the extent that this cannot be done for a project, the EA is incomplete, and would have to be treated as indicative rather than definitive, and clearly reported as such. In what follows here, we shall assume that complete monetarisation is possible.



Some costs and benefits will be expressed in monetary form from the moment at which they are identified. This will almost always be the case for those things that are, under DFID conventions, costs. But as we shall see shortly, the mere fact that a cost is already expressed in a monetary form does not mean that valuation is unnecessary. Observed market prices often diverge from the 'shadow prices' that are appropriate for EA, and so may need to be adjusted in a subsequent re-valuation exercise. This is a process considered at depth in Topic 6.

### What are shadow prices?

"We want to derive a set of shadow prices reflecting the social value of commodities, in order to guide policy reform and the choice of public sector projects. To this end, the shadow price of a commodity is defined as its social opportunity cost, i.e. the net loss (gain) associated with having one unit less (more) of it. The losses and gains involved have to be assessed in terms of a well-defined criterion or objective, which is referred to as 'social welfare'. The evaluation of social welfare is naturally based (at least partly) on assessments of the well-being of individual households, supplemented by interpersonal comparisons of well-being. The latter are embodied in what we shall call 'welfare weights'. This is not the place to debate which weights should be used - they should be discussed responsibly and intelligently but are ultimately value judgements depending, inter alia, on one's views of inequality and poverty."

Dreze and Stern (1990) "Policy Reform, Shadow Prices and Market Prices" (Journal of Political Economy)

Many of the items identified as 'benefits' - whether they be beneficial outcomes of a project or adverse, welfare-reducing impacts - will require valuation because the units in which they have been identified and first measured are non-monetary units. These include such things as changes in health status or life expectancy, better access to water and sanitation, reduced incidence of HIV/AIDS, higher female participation in secondary education, and more representative political processes.

Although most welfare-relevant impacts are initially measured in terms of non-monetary units (such as housing improvements, lives saved, infections avoided), many of them concern changes in items which are exchanged through market transactions. Where that is the case, use of equilibrium market prices **may** (but will not necessarily) serve as a means of shadow pricing: i.e. conversion of costs and benefits into units of a common metric or numeraire that reflects the marginal social value of the impacts. In this regard, Chapter 5 of the UK Treasury Green Book states that:

*"Costs and benefits should normally be based on market prices as they usually reflect the best alternative uses that the goods or services could be put to (the opportunity cost)."*

It adds

*"However, market prices may need to be adjusted for tax differences between options."*

But as we shall see in Topic 6, the circumstances in which adjustments to market prices will be needed to arrive at shadow prices that properly reflect social opportunity cost are far more widespread than merely making adjustments for taxes and subsidies.

Of course, many goods and services are not bought and sold through markets. This is particularly likely for wider social and environmental costs and benefits for which there is no market and so no market price. In such cases, shadow pricing will require that some alternative form of valuation be undertaken to arrive at marginal social opportunity costs in monetary-equivalent units. The Green Book states that (these wider costs and benefits) "*will often be more difficult to assess but are often important and should not be ignored simply because they cannot easily be costed*". Annex 2 of the Green Book provides extensive guidance on how to take into account the wider, unmarketed, impacts of proposals.

## 9. Valuation of Costs

Chapter 5 of the UK Treasury Green Book (along with GB Annex 2) gives general guidance on valuation principles and techniques, and we have already noted that its advice includes the proposition that costs (and benefits) should normally be based on market prices as they usually reflect the appropriate opportunity cost. Green Book guidance covers a variety of matters relevant to cost valuation, a selection of which we examine below.

First, in valuing the use of an employee's time, the Green Book states that:

"[F]ull time equivalent (FTE) costs should be used to estimate the costs of employees' time **to the employer**, and should include where relevant pensions, national insurance and allowances, as well as basic salaries."

### TUTOR'S REMARK:

This comment seems to be driven largely by the affordability (management accounting) criterion referred to earlier. The Green Book implicitly recognises this by stating

"However, the opportunity cost principle implies that the valuation of an employee's time to an employer may differ from its **valuation to society**. (Green Book Annex 2 discusses the valuation of time to society.)"

Many developing economies are 'labour-rich and capital poor'. Where there is extensive unemployment or under-employment, the social value of labour time (its shadow price) is likely to be well below its market or conventional accounting value. It is the valuation to society that is relevant for an Economic Appraisal, although one should explicitly report in the EA where any such divergence is thought to occur, and how the value of labour time has been assessed in the appraisal.

Second, the GB discusses sunk costs. It states that: "*Costs of goods and services that have already been incurred and are irrevocable should be ignored in an appraisal. They are 'sunk costs'. What matters are costs about which decisions can still be made. However, this includes the opportunity costs of continuing to tie up resources that have already been paid for.*"

**TUTOR'S REMARK:** The point here is that even if a cost has already been incurred in financial terms, and that outlay cannot be recovered, the resources acquired may nevertheless have alternative uses open to them. So if they are used in one policy intervention, the opportunity cost that is lost by closing off their use elsewhere must be

included as a project cost even though the initial financial cost may be sunk (and so not relevant as far as affordability is concerned).

Third, "*Depreciation and capital charges should not be included in an appraisal of whether or not to purchase the asset that would give rise to them (although for resource budgeting purposes they may be important).*"

**TUTOR'S REMARK:** These are important remarks, and relate to two of the most commonly made mistakes in economic appraisal where capital investments are made. Depreciation charges are an accounting device and must not be included as a cost in an EA that considers the acquisition of an asset. Nor must capital charges be included; these are dealt with through the process of discounting. However, if capital already acquired has alternative uses, then use of that capital in this project **does** incur an opportunity cost; and that cost should be included in the EA.

Fourth, with regard to residual values, GB notes that "Even where an appraisal covers the full expected period of use of an asset, the asset may still have some residual value, in an alternative use within an organisation, in a second-hand market, or as scrap. These values should be included, and tested for sensitivity, as it may be difficult to estimate the future residual value at the present time."

Contingent Liabilities: Here it is important to keep in mind the distinction between the relevance of contingent liabilities for EA purposes and for affordability purposes. The GB advice is as follows:

*"Some projects expose the government to contingent liabilities – that is commitments to future expenditure if certain events occur. These should be appraised (and monitored if the proposal goes ahead). One class of contingent liabilities is the cancellation costs for which the government body may be liable if it terminates a contract prematurely. Such liabilities, and the likelihood of their coming about, must be taken into account in appraising the initial proposal. Redundancy payments fall into this category, but as the wider social and economic consequences of these should also be assessed, advice from economists should be sought. [Redundancy payments are also examples of transfer payments, which are those for which no good or service is obtained in return. Transfer payments may change the distribution of income or wealth, but do not give rise to direct economic costs.]"*

**TUTOR'S REMARK:** These comments are somewhat ambiguous. The point here is that contingent liabilities can be, and often are, are relevant for economic appraisal. But the appraiser needs to think carefully about their relevance. The basic principle is that if a contingent liability were to result in some financial payment being made (such as when a contract is cancelled) that payment should not be treated as a project cost if it is simply a transfer payment. If, however, a contingent liability has potential real opportunity cost implications, then the expected value of those resource costs should be included in the EA.

## 10. Valuation of Benefits

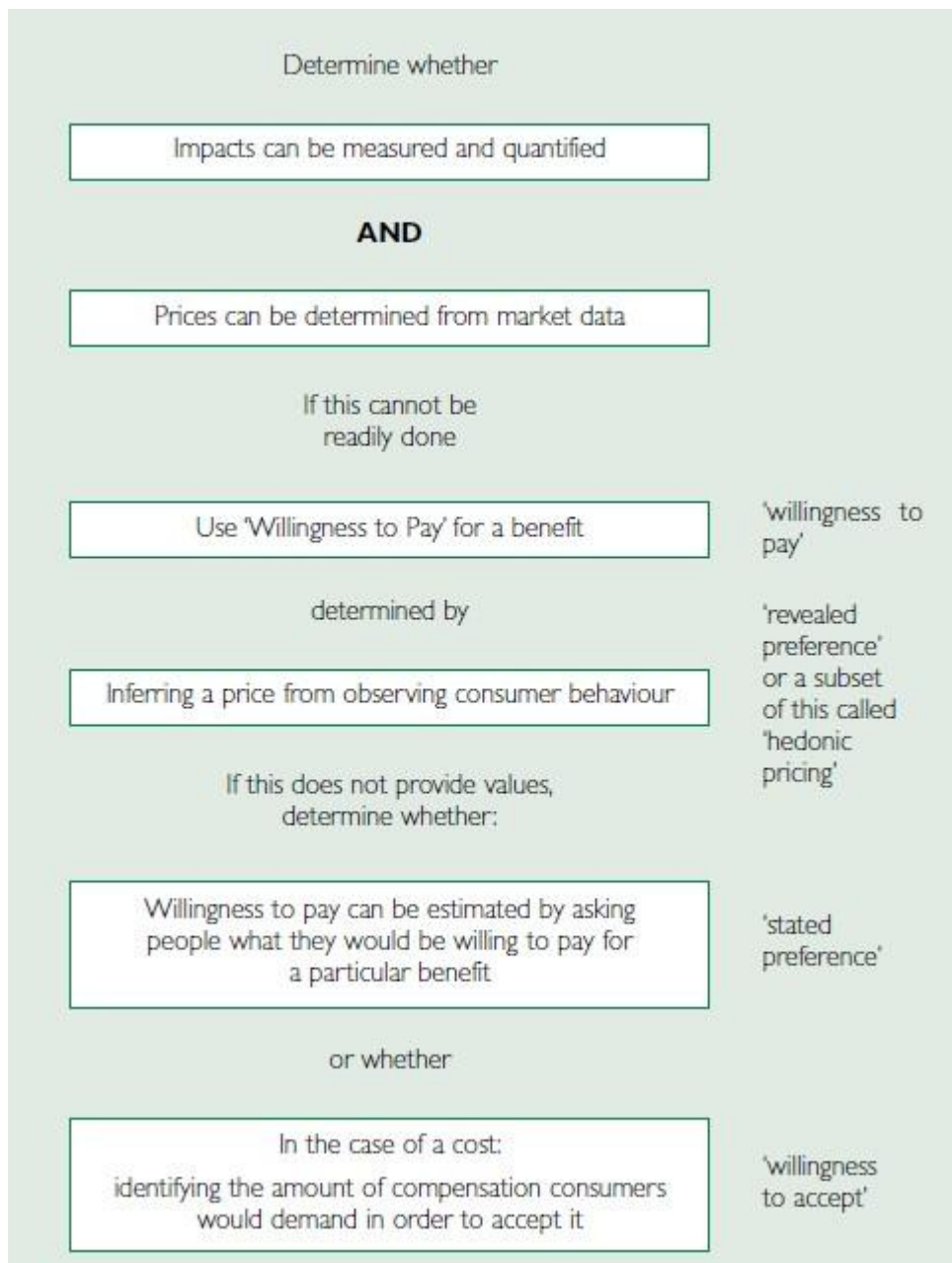
A number of points have already been made about valuation of costs and benefits, and those that apply to benefit valuation do not need to be repeated here.

When it comes to valuation of benefits, there are four main issues to confront:

1. As well as taking into account the **direct** effects of interventions, **indirect** effects need to be considered too. These indirect effects will include what the GB refers to as "the wider effects on other areas of the economy", and may include such things as environmental costs.
2. Where benefits do relate to goods or services that do have a market price, the issue of the **extent to which market prices are reliable guides for valuation** arises.
3. Projects, programmes and policies are likely to have impacts some of which do not have prices that can be observed from market behaviour. Some method of **imputation of values** is therefore required if these benefits (both utility-enhancing and utility-reducing) are to be brought fully within the EA process.
4. Should the values attached to benefits be contingent upon the **distributional incidence** of those benefits? If the answer is yes, how should such distributional issues be operationalised?

None of these four issues is amenable to simple answers; all push our skills as economists to the limit. We shall arrange our discussions below under sub-headings that correspond to the four issues. But first, it will be useful to display the following Green Book graphic (from page 23 of the GB).

#### BOX 10: VALUATION TECHNIQUES



**Issue 1: All impacts of an intervention, direct and indirect, are relevant for EA.**

Box 10 implicitly assumes that this matter has already been resolved. But as we discussed earlier, in discussing the identification of impacts, this is not without problems. The criterion is simple: an impact is relevant if it has welfare impacts. Hence Green Book references to "wider effects on other areas of the economy" that include such things as environmental costs are clearly apposite. But wider indirect impacts might also include indirect and induced multiplier effects, such as would be picked up through Input-Output and Computable General Equilibrium modelling. These are a central concern of Topic 6.

**Issue 2: To what extent are market prices reliable guides for valuation.**

The Green Book seems to be unequivocal in this regard. Chapter 5 of the GB states that:

*"Real or estimated market prices provide the first point of reference for the value of benefits. There are a few exceptions where valuing at market prices is not suitable. If the market is dominated by monopoly suppliers, or is significantly distorted by taxes or subsidies, prices will not reflect the opportunity costs and adjustments may be required and specialist economic advice will be needed. An example of this is the effect of EU subsidies on the market for agricultural land."*

But not all economists would agree with the position that there are only "a few" exceptions to this general rule. It is a standard result of welfare economics that once an economy is generally distorted (so that, roughly speaking, the full set of technological and institutional conditions required to sustain a Pareto efficient competitive equilibrium is not present in more than one particular instance) then all 'first best' resource allocation rules - such as marginal cost pricing - are no longer applicable. This is a complex matter that we shall not go into here, leaving it instead until Topic 7. At this point in the course, it is best to just retain some skepticism regarding the notion that there are just "a few exceptions" where valuing at market prices is not suitable, and to reserve your fuller judgement until later.

### **Issue 3: Imputation of values**

Valuing costs and benefits where there is no market value takes us into a huge area of economics theory and applied research. Most appraisals will identify some costs and benefits for which there is no readily available market data, or for which there is no market - and so market price - and so market price data does not exist. In these cases, a range of techniques can be applied to impute values. Green Book Box 10, reproduced above, shows the main avenues.

Where a market price does not exist, conventional valuation techniques are based on individual willingness to pay (WTP). The notion here is simple:

1. We identify those individuals whose welfare is potentially affected by changes in quantities of the good or service whose valuations are being sought.
2. We next attempt to find out how much each of the affected individuals for whom the good or service being valued would be willing to pay to have additional amounts of that good or service (or how much they would be willing to pay to avoid having additional amounts of it).
3. Where the good or service in question is a **private** good (so it is rivalrous in consumption) then the social valuation of that good or service is given by the highest of the individual valuations.
4. Where the good or service in question is a public good (so it is non-rivalrous in consumption) then the social valuation of that good or service is given by the aggregate of WTP valuations over all affected individuals.

The most difficult step is the second one: eliciting individual WTP valuations. Box 10 suggests two approaches:

- revealed preference methods, the most commonly-used method of which is hedonic pricing
- stated preference methods, the most commonly-used is contingent valuation surveys.

There are very many useful surveys of non-market valuation theory and techniques, some of which are listed in the final page of this lesson. One good survey - but carried out largely in

the context of environmental valuation - written by the tutor (and several colleagues) is available from the following link. This is a "big read" and I certainly do not recommend that you download and read it this week. But it may be useful to you in subsequent work you do.

[Non-Market Valuation: Theory and Techniques \(extracted from Roger Perman et al: "Natural Resource and Environmental Economics" \(3rd edition\)\)](#)

Some general information and advice about how each of these could be carried out is also found Green Book Annex 2, "Valuing Non-Market Impacts". This annex also contains discussions about valuations for several particular generic cases:

- Time valuation
- Valuing health benefits
- Value of a prevented fatality or prevented injury
- Valuing (building project) design quality
- Valuing environmental impacts

The DFID reader may find some of this material frustrating though. Whilst Annex 2 contains many clear descriptions of techniques they are not presented in any technical depth. To actually implement any one of these approaches would involve a far more substantial learning of the theoretical and applied empirical literature. More importantly, I suspect, is that the large majority of reported examples are for valuations in the context of affluent developed countries, a context that is of little relevance for DFID work. This is not a limitation of the Green Book alone; most of the non-market valuation research has been carried out in developed country contexts, and the journal literature reflects this.

The Green Book discusses three ways forward:

1. Using expert in-house staff economists;
2. Contracting out valuation research to external organisation (likely to be extremely expensive, and probably not warranted on most individual projects);
3. Benefit-transfer techniques.

What seems to be important here, particularly if 1. is used is to systematically accumulate valuation information in DFID intranet space. If 2. is used, the tutor would recommend that part of the terms of reference for any externally-contracted valuation research is that deliverables include benefit-transfer functions relevant for developing country contexts. This brings us on to the third of the ways forward: benefit transfer techniques. These make use of the results of previous studies to estimate the economic value of changes stemming from current programmes or policies.

One publically-available database for this purpose is the 'Environmental Valuation Reference Inventory (EVRI)', available at <http://www.evri.ca/>. This is a benefit-transfer database maintained by Environment Canada, and one that UK DEFRA supports financially.) The following box summarises the purpose of the EVRI web resource.

#### **Using the EVRI for benefits transfer**

The EVRI is intended primarily as a tool to assist policy analysts using the benefits transfer approach to estimate economic values for changes in environmental goods and services or human health. In the benefits transfer

approach, the results of the previous studies held within the EVRI can be used (transferred) to estimate the economic value of changes stemming from current programs or policies.

The main challenge faced in conducting an economic valuation with a benefits transfer is in finding the most appropriate studies to use in the transfer exercise. Choosing an appropriate set of studies involves matching the context of the previous economic study(ies), termed study sites, with the context of the current program or policy, termed the policy site. The EVRI has been designed specifically to help economists evaluate the quality of the information about the study site(s) and to match the studies with current policy sites. The EVRI's Searching Module helps the user define the good or service to be valued and identifies studies with potential for transfer. The Screening Module helps the user assess the suitability of the studies identified in the search according to criteria outlined in the benefits transfer literature.

Using the EVRI and the benefits transfer approach appropriately will yield significant time and cost savings as compared to the time and resource intensive process of designing, testing and implementing a new valuation study. Beyond its role in facilitating defensible benefits transfers, the EVRI can assist in the design of new valuation studies since it contains concise, detailed and easily accessed information about the methods and approaches taken in existing valuation studies. In the long run, the EVRI will illustrate the gaps in the body of valuation research with respect to environmental goods and services and different parts of the world.

There will be increasing scope for using this 'benefit transfer' method as databases of this kind expand. In using them, it is vital to take care to allow for different circumstances. The characteristics of the consumers or client group for which data exist may differ from those of the proposal under consideration. These factors can limit the extent to which values can be transferred or generalised.

A central estimate, together with a maximum and minimum plausible valuation, should be included. These figures should be included in sensitivity analyses to give assurance that benefit valuation is not critical to the decision to be made. A plausible estimate of the value of a benefit or cost can often be drawn out by considering a range of issues which are summarised in Green Book Annex 2.

#### **Issue 4: Distributional Weights**

It is important that the distributional implications of each option are considered during appraisal. This type of analysis enhances the understanding of the fairness of proposals, their social impacts and their scale. Hence adjustments will often be required to take account of distributional impacts to develop the Base Case. As for all adjustments, they should be shown separately, clearly and explicitly in any supporting tables of data.

The impact of a policy, programme or project on an individual's well-being will vary according to his or her income; the rationale being that an extra pound will give more benefit to a person who is deprived than to someone who is well off. In economics, this concept is known as the 'diminishing marginal utility of additional consumption'.

Other distributional issues may also arise, and should be considered during appraisal. A proposal may have differing impacts according to age, gender, ethnic group, health, skill, or location. These effects should be explicitly stated and quantified wherever feasible. For example, the costs and benefits of a proposal might be broken down according to the ethnic group they accrue to, providing appraisers with a basis for comparison and analysis.



Generally though, these other distributional issues are largely correlated with income. Therefore, if more in depth analysis is undertaken, it should focus on how the cost and benefits of a proposal are spread across different socio-economic groups.

For the purposes of project appraisal, relative prosperity may often be best defined by relative income, adjusted for household size, and divided into quantiles (e.g. quintiles or deciles).[5: The relative prosperity of a household depends on its size and composition as well as income. The varying costs of living of different households can be adjusted for by calculating equivalised income ranges. Further detail is provided in Annex 5.] The equity impact of competing options can be compared by charting the impact each has on different ‘quantiles’ of the income distribution. Proposals that deliver greater net benefit to households or individuals in lower income quantiles are rated more favourably than those that benefit higher quantiles.

A more in depth analysis uses distributional weights to adjust explicitly for distributional impacts in the cost benefit analysis. Benefits accruing to households in a lower quantile would be weighted more heavily than those that accrue to households in higher quantiles. Conversely, costs would be weighted more heavily for households in lower quantiles. Annex 5 provides further guidance in this area.

A project aiming to improve market efficiency through the correction of market failure needs also to consider equity outcomes. In this case, an explicit adjustment would be particularly helpful as an equity check for the proposal. Similarly, an adjustment is desirable when faced with a decision between competing equity motivated projects, aimed at regenerating areas containing different socio-economic populations.

Applying an explicit distributional adjustment requires quite detailed information about the affected population. A judgement must be made as to whether the necessary socio-economic information is available at an acceptable cost, given the importance of the proposal and the likely scale of the impact of distributional analysis.

Where appraisers decide not to adjust explicitly for distributional impacts, they must provide a justification for this decision. This judgement should be informed by the following considerations:

- The significance of the impact of distributional analysis to the proposal under consideration;
- The ease with which distributional impacts can be measured; and
- The scale of the impact associated with a particular project or proposal.

## **The Proportionality Principle**

All benefits should be valued unless it is clearly not practicable to do so.

## 11. Valuation: some miscellaneous matters

### A. Relative Price Changes

Adjustments will often be required to take account of relative price changes to develop the Base Case. As for all adjustments, they should be shown separately, clearly and explicitly in any supporting tables of data.

The valuation of costs or benefits should be expressed in 'real terms' or 'constant prices' (i.e. at 'today's' general price level), as opposed to 'nominal terms' or 'current prices'.

If necessary, the effect of expected future inflation in the general price level should be removed by deflating future cash flows by forecast levels of the relevant deflator. Over a long-term period, the Bank of England's annual inflation target (currently set by the Government at 2.5%) is the appropriate measure of prices to use as a general deflator.

Where particular prices are expected to increase at significantly higher or lower rate than general inflation, this relative price change should be calculated. Examples where relative price changes may be material to an appraisal include:

- High technology products, prices for which may be expected to fall in real terms;
- Fuel prices, where the resource supply is scarce; and
- Wages, where productivity growth is expected to lead to wage increases above general inflation. (7: HM Treasury (2002), 'Trend Growth: Recent Developments and Prospects', projected trend productivity growth of 2%)

It is helpful when anticipating relative price movements, to consider whether the value of a benefit or a cost will rise as incomes increase. The most direct evidence for this is evidence about how, in fact, revealed preference or stated preference valuations of the benefit in question have increased with income over time. In some cases there is reason to expect that the value of a benefit or cost will rise as incomes increase, for example because the good is in fixed supply (such as certain environmental assets), or because the units in which it is measured are such that its utility value can be expected to remain broadly constant, regardless of changes in income. In the absence of definitive data, the rate of increase in the real value of the benefit should be assumed to be positive, and only in unusual circumstances would it exceed the projected rate of increase of per capita real income. [8: Any reduction in the discount rate in the longer term should be linked to a proportional decrease in the projected rate of growth of income. ] Where these assumptions are critical, they should be tested against any specific evidence.

For other costs and benefits, the factors listed below might be considered in determining whether their value would change by more or less than inflation.

- Scarcity. If a good is exhaustible, its relative price may be expected to rise at a faster rate than general prices, as it becomes increasingly scarce. Against this, developing technologies may enable more of a good to be extracted than initially thought possible.

- Substitutability. Where plenty of substitutes are available, any scarcity impact may be largely offset. Consideration should be given to whether substitutes are likely to develop over time, particularly in the case of exhaustible goods.
- Non-linearity. Some of the damage resulting from pollutants, for example, will be non-linear. If the quantity of a pollutant changes over time, this non-linearity will affect the rate at which its relative price changes.
- Increasing competition, or the removal of monopoly powers, would increase the availability of goods and services, and relative prices may be expected to decline.
- Economies of scale. If the size of the market for a particular good or service increases, then there is a greater potential for economies of scale, and relative prices may then also be expected to reduce.

## **B. Adjustment for Taxes and Subsidies**

The adjustment of market prices for taxes in appraisal is appropriate where it may make a material difference to the decision. In practice, it is relatively rare that adjustments for taxation are required, because similar tax regimes usually apply to different options. It can also be difficult in practice to estimate costs net of tax. However, where the tax regimes applying to different options vary substantially, this should not be allowed to distort option choice. In such cases it is important to adjust for any differences between options in the incidence of tax arising from different contractual arrangements, such as in-house supply versus buying in, or lease versus purchase. Options attracting different VAT rates, for example, should be compared as if either the same VAT payments, or no payments were made in all cases.

Where publicly financed options are compared to PFI options, taxation differences should be considered, and adjustments explicitly made if not doing so would materially distort the decision. Specific guidance is available on the Treasury Green Book homepage on how to do this in practice.

## **12. Discounting**

We shall be reviewing the theory and practice of discounting at some length in the next topic, on performance measurements. At this point we shall restrict ourselves to making a few simple points, based in the main on the treatment of discounting in the Green Book (and some of the wording on this page is taken directly from that source).

Discounting is a technique used to compare costs and benefits that occur in different time periods, and to allow the appraiser to convert all monetized costs and benefits accruing in any year of the project lifetime to ‘present values’, so that they can be compared and aggregated.

The justification for discounting is based on two principles:

### **1. Time preference**

Other things being equal, individuals prefer to have utility enhancing goods or services earlier rather than later. Given this, in order to persuade individuals to defer consumption until later dates it is necessary to provide some reward for that deferral to offset their time preference.

The higher their time preference, the higher will the reward needed to induce a given amount of consumption deferral until later in time.

Thus for individuals, time preference is reflected in, and can be measured by, the real interest rate on money lent or borrowed. Amongst other investments, people invest at fixed, low risk rates, hoping to receive more in the future (net of tax) to compensate for the deferral of consumption now. These real rates of return give some indication of their individual pure time preference rate.

Economists argue that this notion also applies to society as a whole; that is, society prefers to receive goods and services sooner rather than later, and to defer costs to future generations. This is known as ‘social time preference’; the ‘social time preference rate’ (STPR) is the rate at which society values the present compared to the future.

## **2. The opportunity cost of capital**

The argument here is that capital is inherently productive, and can generate a positive rate of return. If funds that are available either for consumption or investment are used for consumption rather than investment purposes then that rate of return is given up. This is the opportunity cost of capital.

In terms of interest rates, we can also couch this argument a different way. If capital is inherently productive (and let us say can earn a rate of return of  $r$  per year) then someone who sees an investment opportunity that would yield this rate of return would be willing to pay an interest rate of up to  $r$  per year to borrow funds to finance that investment.

### **Linking these two principles**

In a well-functioning capital market, interactions between lenders would create demands for and supplies of funds for investment. In equilibrium, where the supply and demand for loanable funds are equated, an equilibrium interest rate will emerge. This rate will equal both the marginal rate of individual time preference and the marginal rate of return on capital.

Clearly, this brief account is something of a simplification. Nevertheless, it does explain why one can come at the discount rate from two different perspectives, one based on time preference and the other the real rate of return on capital. We shall take this matter further in the next topic.

The recommended discount rate is 3.5%. However, for projects with very long-term impacts (over thirty years), a declining schedule of discount rates should be used rather than the standard discount rate. Green Book Annex 6 shows the schedule of long term discount rates. It also explains the derivation of the social time preference rate, why the rate declines over time, and the circumstances when exceptions to the standard discount rates are allowed.