Cost Benefit Analysis

In a world of finite public and private resources, we need a standard for evaluating trade-offs, setting priorities, and finally making choices about how to allocate scarce resources among competing uses. Cost benefit analysis provides a way of doing this.

The cost-benefit principle says that you should take an action if, and only if, the extra benefit from taking it is greater than the extra cost

Here are some examples where the principle might be built into your analysis and evaluation

1. Costs and benefits of subsidies e.g. the bio-fuel debate or subsidies
2. Costs and benefits of the introduction of competition e.g. postal market liberalisation
3. Costs and benefits of different strategies designed to reduce income and wealth inequality e.g. the national minimum wage or a rise in the top rate of income tax
4. Costs and benefits of the introduction of carbon trading as a way of reducing CO2 emissions
5. Costs and benefits of major infrastructural projects such as new motorways, London 2012
6. Costs and benefits of a decision to relax planning controls on new house-building

What is cost benefit analysis?

Cost benefit analysis (COBA) is a technique for assessing the **monetary social costs and benefits** of a capital investment project **over a given time period**. The principles of cost-benefit analysis (CBA) are simple:

1. **Appraisal of a project:** It is an economic technique for project appraisal, widely used in business as well as government spending projects (for example should a business invest in a new information system)
2. **Incorporates externalities into the equation:** It can, if required, include wider social/environmental impacts as well as 'private' economic costs and benefits so that externalities are incorporated into the decision process. In this way, COBA can be used to estimate the social welfare effects of an investment
3. **Time matters!** COBA can take account of the **economics of time** – known as **discounting**. This is important when looking at environmental impacts of a project in the years ahead

Uses of COBA

COBA has traditionally been applied to big public sector projects such as new motorways, by-passes, dams, tunnels, bridges, flood relief schemes and new power stations. Our example later considers some of the social costs and benefits of the new Terminal 5 for Heathrow airport.

The basic principles of COBA can be applied to many other projects or programmes. For example, - **public health programmes** (e.g. the mass immunization of children using new drugs), an investment in a **new rail safety systems**, or opening a new railway line. Another example might be to use COBA in assessing the costs and benefits of introducing **congestion charges** for motorists in London. Cost benefit analysis was also used during the recent inquiry into genetically modified foods. Increasingly the principles of cost benefit analysis are being

used to evaluate the returns from investment in environmental projects such as wind farms and the development of other sources of renewable energy, an area where the UK continues to lag behind.

Because financial resources are scarce, COBA allows different projects to be ranked according to those that provide the **highest expected net gains in social welfare -** this is particularly important given the limitations of government spending.

Main Stages in the Cost Benefit Analysis Approach

At the heart of any investment appraisal decision is this basic question – **does a planned project lead to a net increase in social welfare?**

- Stage 1(a) **Calculation of social costs & social benefits.** This would include calculation of:
    - **Tangible Benefits and Costs** (i.e. direct costs and benefits)
    - **Intangible Benefits and Costs** (i.e. indirect costs and benefits – externalities)
- *This process is very important – it involves trying to identify all of the **significant** costs & benefits*
- Stage 1(b) - **Sensitivity analysis of events occurring** – this relates to an important question - If you estimate that a possible benefit (or cost) is £x million, how likely is that outcome? If you are reasonably sure that a benefit or cost will 'occur' – what is the scale of uncertainty about the actual values of the costs and benefits?
- Stage 2: - **Discounting the future value of benefits** - costs and benefits accrue over time. Individuals normally prefer to enjoy the benefits now rather than later – so the value of future benefits has to be discounted
- Stage 3: - **Comparing the costs and benefits** to determine the net social rate of return
- Stage 4: - **Comparing net rate of return** from different projects – the government may have limited funds at its disposal and therefore faces a choice about which projects should be given the go-ahead

Evaluation: Criticisms of COBA

There are several objections to the use of CBA for environmental impact assessment:

1. **Problems in attaching valuations to costs and benefits**: Some costs are easy to value such as the running costs (e.g. staff costs) + capital costs (new equipment). Other costs are more difficult – not least when a project has a significant impact on the environment. The value attached to the destruction of a habitat is to some "priceless" and to others "worthless". Costs are also subject to change over time – I.e. the construction costs of a new bridge over a river or the introduction of electronic road pricing
2. **The CBA may not cover everyone affected** (i.e. all third parties) – inevitably with major construction projects such as a new airport or a new road, there are a huge number of potential "stakeholders" who stand to be affected (positively or negatively) by the decision. COBA cannot hope to include all stakeholders – there is a risk that some groups might be left out of the decision process
    a. Future generations – are they included in the analysis?

    b. What of “non-human” stakeholders?

3. **Distributional consequences:** Costs and benefits mean different things to different income groups - benefits to the poor are usually worth more (or are they?). Those receiving benefits and those burdened with the costs of a project may not be the same. Are the losers to be compensated? To many economists, the equity issue is as important as the efficiency argument.
4. **Social welfare is not the same as individual welfare** - What we want individually may not be what we want collectively. Do we attach a different value to those who feel “passionately” about something (for example the building of new housing on greenfield sites) contrasted with those who are more ambivalent?
5. **Valuing the environment:** How are we to place a value on public goods such as the environment where there is no market established for the valuation of “property rights” over environmental resources? How does one value “nuisance” and “aesthetic values”?
6. **Valuing human life:** Some measurements of benefits require the valuation of human life – many people are intrinsically opposed to any attempt to do this. This objection can be partly overcome if we focus instead on the probability of a project “reducing the risk of death” – and there are insurance markets in existence which tell us something about how much people value their health and life when they take out insurance policies.
7. **Attitudes to risk** – e.g. a cost benefit analysis of the effects of genetically modified foods
    a. **Precautionary Principle**: Assume toxicity until proven safe
        i. If in doubt, then regulate
    b. **Free Market Principle**: Assume it is safe until a hazard is identified
        i. If in doubt, do not regulate.
8. Weighing qualitative factors such as social inclusion effects, policy integration/cohesion, accessibility/discrimination and the “legacy effects” of capital investment

Despite these problems, most economists argue that CBA is better than other ways of including the environment in project appraisal.

Discounting the future

Would you rather have £1000 of income today or £1000 of income in the future (say in 3 years?). The answer is probably now, because £1000 in three years time is unlikely to buy as many goods and services as it does now (because of inflation). And also because £1000 put into a savings account today will yield interest.

Discounting is a widely used technique as part of cost benefit analysis. The technique of discounting reflects the following:

The value of a cost or benefit now > the value of a cost or benefit in future years

Discounting reflects this by **reducing all future costs and benefits to express them as today’s values**. The key question is: How do you choose an ‘interest rate’ for reducing future costs to give them a **present value** today?

Setting a general discount rate for new projects has important implications for the environment:

1. A low discount rate is often favoured by economists since they argue that investing a high proportion of current income is a good way of providing for the future

2. A high discount rate may also be favoured since it discourages investment (and by implication environmental damage) in the present

Most projects have lifetimes of 20-30 years – with many of the big costs arising early in a project e.g. from construction whereas the stream of benefits from a project occur over a much longer period of time. But for many huge construction projects, some of the costs only become apparent in the long run. Consider the building of a new nuclear power station. Environmentalists would argue that there is a long list of costs from waste management and decommissioning which stretch over 100 years into the future whereas no social benefits exist to offset these costs beyond year 30 or 40 (where the nuclear power station might reasonably be expected to be ready for closure).

The value of decommissioning costs over 100 years away is almost negligible no matter what discount rate we use. This makes discounting difficult to justify

Revealed Preference – Valuing the Benefits from a Project

According to some economists, the valuation of benefits and costs used in COBA should reflect the **preferences revealed by choices** which have actually been made by individuals and businesses in different markets.

Information contained in the demand curve tells us much about how much people are willing and able to pay for something. This is important in revealed preference theory. When consumers make purchases at market prices they reveal that the things they buy are at least as beneficial to them as the money they relinquish.

Cost benefit analysis in practice – Heathrow Terminal 5

The debate over whether there should be a fifth terminal at Heathrow airport has fierce and long-lasting! The official planning enquiry reported after 5 years and having cost many millions of pounds. The rival arguments at the inquiry highlighted many examples of environmental impact (externalities) - noise, air quality, rivers etc. - but concluded that these were not enough to refuse planning permission and that the new terminal project should go ahead.

The case for terminal 5

1. **Economic growth**: Demand for air travel in south-east England is forecast to double in the next 20 years, making expansion vital – many thousands of jobs and businesses depend on Heathrow airport expanding to provide sufficient supply capacity to meet this growing demand. An increase in the capacity of Heathrow will make best use of airport's existing infrastructure and land (nearly 3,000 acres).

2. **The economy and trade**: The UK will lose airlines and foreign investment to European rivals if it does not meet demand. The benefits of a world-beating industry would be diminished – many sectors of our aviation industry have a comparative advantage and add huge sums to our balance of payments

3. **Jobs:** The terminal 5 project will create or safeguard an estimated 16,500 jobs, as well as creating 6,000 construction jobs during the building phase – this will have multiplier effects on the local / regional and national economy

4. **Transport**: The terminal will be the centre of a world-class transport interchange, with new Tube and rail links. Car traffic would rise only slightly – the social costs of increased traffic congestion have been exaggerated by the environmentalists

5. **Environment**: The site earmarked for terminal 5 is currently a disused sludge works, and any displaced wildlife and plant life will be carefully relocated. The noise climate

around Heathrow Airport has been improving for many years, even though the number of aircraft movements has increased considerably – partly due to the phasing out of older, nosier aircraft

6. **Noise and night flights**: BAA promises no increase in overall noise levels or in night flying. The number of flights would rise only 8%

The objections to Terminal 5

1. **Growth:** BAA forecasts are misleading and will lead to uncontrolled expansion, rather than targeting better solutions such as using existing space at other airports.
2. **The economy**: Heathrow already has the biggest capacity in Europe, and ambitions to extend its lead are merely "commercial prestige" rather than having long term macroeconomic benefits
3. **Jobs**: Only 6,000 jobs will be created - a tiny fraction of all the new jobs in the South East. Local studies say jobs will increase anyway even without a fifth terminal
4. **Transport:** There will be a significant increase in road-widening and car parks to cater for the tens of thousands of extra car journeys to the airport every year
5. **Environment**: Air pollution will increase significantly, and hundreds of acres of wildlife and Green Belt land will be lost forever. Plus the environmental costs of increased traffic congestion
6. **Noise and night flights**: More flights will mean more noise under the flight paths, and the pressure for controversial night flights and a third runway will increase – the regulators will be captured by the airlines and airport authorities and will eventually be pressurized into giving way on allowing more night time flights

These are just a few of the arguments raised for and against the Terminal 5 project. For more news on the project consult www.baa.com/main/airports/heathrow/terminal_5_frame.html

A national smoking ban

According to a cost benefit analysis performed for the Chief Medical officer's Annual Review of Public Health published in July 2004, a ban on smoking in public places would benefit the economy by between £2.3bn and £2.7bn a year. The COBA argued that a ban on smoking in pubs, restaurants and cafes would not reduce profits in the leisure, catering and hospitality industry. However critics of the new study responded by saying that the assumptions behind the economic model, remained unpublished. The main findings of the cost benefit analysis are summarised in the table below.

Annual Benefits	£ million
Health benefits (reduced absenteeism)	70 – 140
Health benefits (reduced costs of healthcare)	4
Health benefits (averted deaths from second-hand smoke amongst employees)	21
Health benefits (reduced uptake, particularly new young employees)	550
Health benefits (smoking cessation)	1600
Safety benefits (damage, deaths, injuries)	57
Safety benefits (cost to fire services)	0.2
Safety benefits (administration costs)	6.3
Cost savings to NHS from smoking cessation	Not estimated
Cleaning costs and damage to equipment avoided	100
Production gains	340 – 680

Total	**2700 - 3100**
Annual Costs	£ million
Production losses (smoking breaks)	430
Losses to continuing smokers (loss of satisfaction)	155
Losses to quitters (loss of satisfaction)	550
Losses to the Treasury	1145
Total	

Some of the stakeholders affected by the smoking ban include the following

Losers from the decision	**Winners from the decision**
Dry-cleaners (smoke-free pubs mean less need for people to launder suits and other clothes)	Packaging companies – the demand for beer cans has increased as more people drink at home
Specialised tobacconists	Pizza delivery companies – more people ordering take-away instead of pub meals
Bingo halls	Manufacturers of outdoor patio heaters, awnings and decking
Pubs – pub closures in the UK have run at a net rate of 27 per week during 2008	Cigarette companies – domestic demand for cigarettes has fallen but they have offset this by growing sales to Eastern Europe – helped by the falling exchange rate

A number of major infrastructural projects are planned in the UK over the coming years. Each of them could be considered using some of the principles of cost-benefit analysis. Examples include:

1. **Nuclear power plants**: Expansion or renovation planned at more than a dozen nuclear facilities, raising concerns about safety and waste disposal.
2. **Reservoirs**: To combat long term water supply shortages the government is planning to expand six reservoirs in the South and South-east
3. **Incinerators**: New EU environmental regulations could lead to the building of three massive, centralised disposal units for millions of tonnes of commercial and household waste.
4. **Airports and extra runways**: With an extra 100m passengers predicted to be using UK airports by 2030, there are new runways planned for four airports as part of a huge expansion programme.
5. **The Severn Barrage**: Harnessing tidal power could generate up to 5 per cent of Britain's electricity needs from the Severn Barrage alone.
6. **Gas pipelines**: Six huge underground gas fields built after surge in imports of liquefied petroleum gas and collapse in North Sea supply.
7. **New roads**: About 500 miles of extra roads are planned together with a series of road widening schemes

To recap, cost benefit analysis is basically an **appraisal technique** that tries to place monetary values on all benefits arising from a project and then compares the total value with the project's total cost. It has numerous potential applications although there are inherent difficulties with the issue of valuation. Essentially the process of COBA is a comparative one, so that we can perhaps make judgements about which projects from a limited choice should be given the go ahead.

Suggestions for further reading on cost benefit analysis

Severn barrage will be costly ecological disaster, say environment groups (Guardian, June 2008)