

Evaluation of Public Expenditure = Cost - Benefit Analysis

7.1. MEANING

In the last chapter, we examined the principles which help to determine the level of public expenditure. We tried to show how such determination based on consumer choice encounters formidable difficulties and how these difficulties are sought to be solved by the political process of voting. Let us now assume that the voters delegate expenditure decisions to their representatives. The representatives are then required to select projects from among the various alternatives on which to spend taxpayers' money. How is this selection to be made? It is true that few investment projects are selected on economic criteria alone. Other concerns including national security or the political or personal interests of policy makers often play a role. But economic analysis can indicate the potential effect of proposed projects on growth or poverty alleviation and can help prevent costly mistakes. The basic technique of economic appraisal is cost-benefit analysis. It consists of adding up all the benefits and costs of the project to society, discounting them to reflect the opportunity cost of the invested funds, and calculating the absolute amount of discounted net benefits expected from the project (the net present value).

Cost-benefit analysis "purports to describe and quantify the social advantages and disadvantages of a policy in terms of a common monetary unit. Thus, the building of a new motorway will involve costs (disadvantages to society) of construction, costs of maintenance and 'costs' in the form of changes in noise levels, pollution from exhausts, disfigurement of the landscape and, possibly, more accidents. The benefits (advantages) will consist of savings in travelling time by both commercial and private road users, reduced congestion (and hence more time savings) on roads which would otherwise have been used, and savings in the size of vehicle fleet since fewer lorries can now be used more intensively to meet the same level of demand."¹

The list of costs and benefits mentioned above includes both real and pecuniary, direct and indirect, and so forth. The major categories may be distinguished.²

Benefits and costs may be real or pecuniary

Real benefits and costs may be :

- direct or indirect
- tangible or intangible
- final or intermediate
- inside and outside

The division into real and pecuniary (money) costs and benefits is the most important distinction. Real benefits are derived by final consumers of a project, while real costs consist of resource withdrawal from other uses. Pecuniary benefits and costs occur because of the changes in relative prices caused by the provision of the public service. Such changes in prices offer gains to some individuals and cause losses to others and so become important when one examines the distributional consequences.

Another point that emerges from the list of costs and benefits is that it embraces a social aspect. In order to understand this let us take the case of a private company operating buses and charging fare for their use. The company is guided by the aim of profit maximization. So its concern would be with the construction and operating costs and with the revenues from fares. Buses cause accidents and environmental deterioration too which involve costs. These are borne by third parties and do not enter into the cost estimation of the company. "As long as property rights do not exist in respect of these third-party, or 'external' effects, private enterprise is unlikely to take account of them. It follows that an enterprise adopting a CBA approach has as its objective function (the magnitude which it aims to maximise) net benefits of society (NSB), whereas the objective function of firm is net private benefits."³

Thus there is a difference between cost-benefit appraisal of expenditure policies and an appraisal in terms of private returns. The former attempts to allow for all the gains and losses as viewed from the social standpoint.

7.2. THE ORIGINS OF COST-BENEFIT ANALYSIS

The Theory underlying cost-benefit appraisal can be traced back to the welfare economics of the nineteenth century. The first practical embodiment of the maximisation of net benefit occurred in the 1930s in the United States in the realm of water resources. The Flood Control Act of 1936 established "the principle of comparing benefits to whomsoever they may accrue with the estimated costs." This indicates unmistakably the social nature of the public investment decision. Earlier, the evaluation of federal expenditures in the field of navigation had been undertaken by the Corps of Engineers. The Green Book of 1950 produced by the Federal Inter-Agency River Basin Committee and the Bureau of Budget's Budget Circular A-47 of 1952 made real attempt to instil order into the diverse and loosely defined cost-benefit criteria. In the 1950s academic interest in the CBA analysis was also growing. The real turning point came, however, in 1958 "with the simultaneous publication of works by Eckstein, McKean and Krutilla and Eckstein". "These publications attempted "to formalise public investment criteria in relation to the established criteria of welfare economics. Thus benefits were related back to the consumers' surplus criteria of Dupuit, Marshall and others, and ranking in terms of net social benefits was justified in terms of Pareto criteria for welfare maximisation."⁵

The interest in cost-benefit analysis is growing in developing countries as well. It is being widely used for the appraisal of hydroelectricity schemes, irrigation and general water-supply programmes and for transport investment.

7.3. ANALYSIS

(1) Welfare Foundations of Cost-benefit Analysis :

From the above it should be clear that when the economist makes the cost-benefit appraisal of a project, he is not asking a different sort of question from the one being asked by a private firm. He examines the same question for a wider group of people—the society. The private entrepreneur's interest lies in his own betterment, while the economist tries to know whether the society as a whole will become better off or not by the undertaking of a particular public project. In order to answer this question he substitutes the concept of revenue to the private firm—a more precise concept—by the meaningful, though less precise, concept of social benefit. Further, it is the concept of opportunity cost that takes the place of costs of the private firm. Opportunity cost is the social value foregone when resources are used in the particular public project. Thus the construction of a highway takes away resources which would otherwise have gone into the production of goods and services in the private sector. Then, the concept of profit of the firm is replaced by the concept of excess of social benefit over cost, that is, net benefits.

The aim of cost-benefit analysis is thus to channel resources into projects which will yield

the greatest gain in net benefit to society. Maximisation of net benefit means the maximisation of social utility or social welfare. Dupuit was the first to examine this problem in 1844 in his paper *On the Measurement of the Utility of Public Works*. Let us understand his argument in terms of Fig. 7.1. drawn under the assumption of perfect competition.

In Fig. 7.1, it is assumed that the undertaking of the project lowers the marginal cost from MC_1 to MC_2 . Consequently, the market price is determined at D, the point of intersection of the new marginal cost with the demand curve BQ. At the new price, consumers are willing to pay OB for the quantity OE. The area OBDE consists of two parts — OHDE, the amount actually paid, and HBD, the extra amount they are willing to pay, called consumer's surplus. At C, the price which the consumers were willing to pay was OBCK. So the change in the willingness to pay as a result of lower price is KEDC. In other words, the lower price increases gross benefit by the area KEDC. The increase in benefits involves extra costs of KEDF. Hence the net gain in benefits is the triangle FDC. This triangle consists of two parts, GCD and GFD. GCD is the gain in consumer's surplus whereas GFD is the gain in producers' surplus.

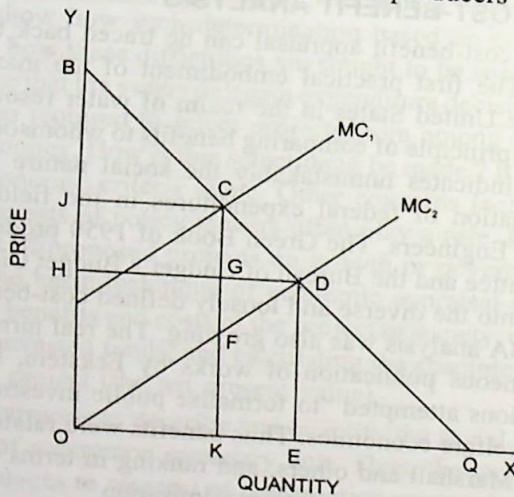


Fig. 7.1

Given linear demand and supply schedules, combined surplus is $\frac{1}{2} \cdot CF \cdot GD$ (that is, the area of the triangle FCD) and consumer's surplus is $\frac{1}{2} \cdot \Delta P \cdot \Delta Q$ (area of the triangle GCD in the present case).

Dupuit suggested the use of combined surplus in order to measure change in welfare arising from the imposition of a toll on a bridge crossing. But this analysis can be extended to the case of new investment. Marshall later adopted consumer's surplus concept to measure the change in welfare under the restrictive assumption of constant marginal utility of income. Other assumptions of this analysis were the cardinal indicators of utility gains and losses and identical utility scales for each person. Under these assumptions there was no problem in adding up individual surpluses and losses.

Cardinal utility came under severe attack at the hands of ordinalists. Hotelling and Hicks argued, however, that consumer's surplus concept can still be retained by dropping the assumptions of cardinal utility and constancy of marginal utility of income.

Another approach to measure the change in social welfare is the Pareto optimum which is described a state in which no one person could be made better off without someone else being made worse off. So if a change in economic organisation that makes everyone better off, or more precisely, that makes one or more members of society better off without making anyone worse

off, is a Pareto improvement. Since interpersonal comparison of utility is ruled out by ordinalists, Pareto optimum can not analyse a situation in which a change benefits some persons and harms others. Kaldor-Hicks compensation principle is an attempt to use Paretian optimum to explain this situation. A change which produces gains that exceed in value of the accompanying losses is an improvement. In other words, a change increases social Welfare if it is such that gainers can fully compensate all the losers and yet remain better off than before.

Welfare foundations of cost-benefit analysis, whether the consumer's surplus approach or the Pareto optimum approach, are not of much value. They are based on a number of very restrictive assumptions. Consumer's surplus approach, even stripped of its cardinal utility assumption, is useless on the ground, as indicated by Little, that the demand curve is only partial and fails to consider the effect of investment on the prices of all other goods. Thus changes in surplus that may occur elsewhere are not taken into account in the analysis of the project in question.

Pareto improvement ignores the resulting change in the distribution of incomes. "Not only is it true that not everyone is made better off, it is also possible that those in the community who are made worse off are to be found largely among the lower-income group."⁶ Suppose a change makes the rich better off by ₹ 3,00,000 at the expense of the poor who are made worse off by ₹ 2,00,000. There is an excess gain of ₹ 1,00,000 for the society as a whole. But such an economic change which worsens the inequality in income distribution may not be acceptable to the majority opinion. Kaldor-Hicks compensation principle is no solution of this problem since it considers only hypothetical, not actual, payment to losers.

The Scitovsky double criteria try to show that if the economic change is large enough to cause prices to change, Kaldor-Hicks compensation criterion may become inconsistent. The gainers could compensate the losers after the change, yet the potential losers might be able to compensate the potential gainers prior to change. An ambiguous increase in welfare takes place when the value of net output must increase both at the new and the old prices. Graaff has argued that most policies involve a loss of Welfare to someone. So a formal basis for interpersonal comparisons is needed. He argues further that the economist has no particular right to attach social weights to individual welfare in the social welfare function. Hence no rigid prescriptions should be made.

(2) Application of Market Principle

We now leave the normative world of welfare economics and consider the application of market principle to cost-benefit analysis. In this situation we take the budget director allocating a given sum of money between projects in the same way as the head of a consumer household allocates the family budget. The director must determine the cost involved in providing each project and the benefit to be derived therefrom. Let us suppose that there are two expenditure projects, X and Y. Further, C denotes cost and B benefit. What the director must attempt to do is to derive the greatest total benefit from the budget. It means maximisation of net benefits to society, that is, the excess of total benefits, ΣB over total costs, ΣC . The size of the budget gives ΣC . So what is needed is simply to maximize ΣB .

Maximization of Total Benefits — Fixed Budget

(a) *Divisible Projects* : If we assume that projects are divisible, the task is simple. When a unit of money is spent on project X, its opportunity cost is the benefit lost from not spending it on project Y, and vice versa. Net benefit is the maximum when total benefits minus total costs are the highest. This is attained if $MB_x/MB_y = MC_x/MC_y$ where MB is marginal benefit and MC is marginal cost. Let us suppose that a total sum of G is to be spent on two projects X and Y. If G is divided between them in such a way that OM is spent on X and ON on Y, total benefit is the highest since marginal benefit PM from OM equals marginal benefit PN from ON. It will

Benefits

Under the assumption of perfect competition, full employment, cardinal utility and absence of external economies, prices are perfect measures of benefit. "The area under the output's demand curve then constitutes a measure of benefits, and if the curves are assumed linear, an arithmetic average of old and new prices multiplied by the number of units will measure benefit."⁷ Such a simple definition of benefits is not available in other cases which depict the real situation.

Most public projects confer two types of benefits — direct and indirect. Direct benefits accrue to the users of the service directly. Indirect benefits, also known as externalities, accrue to third parties. There can be no question that direct benefits are to be included in the estimation of benefits. Externalities pose a serious problem since it has to be decided whether they are to be included or not and whether all of them are to be included. It is generally held that "only real or technological benefits, those increasing output potential of society other than through direct use activity, are relevant whereas strictly pecuniary benefits are not. Included in real benefits are reductions in outlays and resource use for other governmental activities..."⁸

Pecuniary benefits may take the form of lower input costs or increased volumes of business, increased land values and the like. They should not be included because many of them are distributional in nature. Hence benefits to some persons accrue at the cost of loss to others.

Valuation of benefits is a more difficult task. If benefits can be sold directly to users in a perfect market, they can be calculated on the basis of the amounts the users are willing to pay. In other words, the revenue obtained from the sale of the services under perfect competition is the measure of direct benefits. This amount equals consumers's surplus — the difference between total willingness-to-pay and the cost of the project. Other activities, where such sale is not possible, create difficulties. Lack of perfect competition creates another problem. In developing countries major public projects may have such profound impact upon the whole price structure that valuation of benefits at either old or new prices is likely to give a misleading picture of actual benefits. In order to overcome this difficulty, the use of shadow price is suggested. This price covers the worth of social benefits or losses that are either unpriced by the market or unsatisfactorily priced. "Unpriced or unsatisfactorily priced benefits or losses may be valued by the price of similar things in other parts of the country, or by calculating the spill-over effects either by reference to market prices or by other methods."⁹ Valuation of externalities is an even more difficult problem.

Costs

Estimation of costs also presents difficulties, though to a lesser degree. "Costs of the project may be defined as the present value of resources that will be used in the project, valued at their opportunity cost, that is, the amount that would be paid for them for alternative use."¹⁰ Direct costs comprise capital costs and operating and maintenance costs over the years. Indirect costs include costs to society not directly borne by the government.

7.5. LONG-TERM PROJECTS AND THE NEED FOR DISCOUNTING

Cost-benefit analysis is relevant particularly for long-term projects. For such projects, costs are incurred currently as well as in future. Benefits accrue over a number of years. To evaluate future costs and benefits, they have to be translated into present values. Such a translation needs to discount the future benefits since they are less valuable than present ones. This applies to the evaluation of costs as well. "The opportunity cost of resources withdrawn from the private sector should now be measured in terms of the present value of private consumption foregone, where future consumption losses (due to foregone investments) are similarly discounted to their present value."¹¹

Choosing the discount rate needs much care. But what is the appropriate discount rate? At a purely theoretical level, there are many such rates. First, assume that benefits and costs of the

public projects have been measured correctly. Net benefits are anticipated changes in consumption resulting from the project. We are interested in consumption because it is consumption alone that affects human welfare. From this it follows that the appropriate rate of discount would be a social time preference rate, *i.e.*, the rate at which people are willing to substitute one period's consumption for another.

It is also to be noted that the use of resources for a public investment means that these same resources cannot be used for private investment. From this point of view, another appropriate rate of discount is the rate of return on private investment.

7.6. APPRAISAL

The effectiveness of cost-benefit analysis is subject to many limitations. This analysis offers no solution to the problem of optimal outputs of social goods. It is not of help in establishing national priorities (defence versus education, for instance). Another limitation relates to the difficulties of measuring social benefits and costs.

The greatest usefulness of this analysis lies in the fact that costs as well as benefits should be considered in selecting alternative public projects.

NOTES

1. D.W. Pearce, *Cost - Benefit Analysis*, Macmillan, 1971, p. 8.
2. R.A. Musgrave and P.B. Musgrave, *op. cit.*, p. 159.
3. D.W. Pearce, *op. cit.*, p. 9.
4. *Ibid.*, v. 14.
O. Eckstein, *Water Resource Development*, Harvard University Press, 1958.
R. McKean, *Efficiency in Government Through Systems Analysis*, Willey, New York, 1958.
J. Krutilla and O. Eckstein, *Multiple Purpose River Development, Resources for the Future*, Johns Hopkins University Press, 1958.
5. *Ibid.*, p. 14.
6. E.J. Mishan, *Elements of Cost-Benefit Analysis*, George Allen and Unwin, 1972, p. 15.
7. O. Eckstein, (*A Survey of the Theory of Public Expenditure Criteria*,) in E.W. Houghton, *Public Finance*, Penguin, 1970, p. 126.
8. J.F. Due and Ann. F. Friedlaender, *op. cit.*, p. 168.
9. E.J. Mishan, *op. cit.*, p. 69.

The use of shadow prices suggests that these prices give a better efficiency evaluation of projects from the social point of view as they are believed to reflect true social costs and true social benefits of any project. Theory holds that if there is perfect competition in all the markets of an economy and therefore full employment of resources, the money costs and revenues of an investment will be the true measures of its real (social) costs and real (social) benefits. Market prices of inputs then reflect their relative scarcity and are equal to the value of their marginal productivities, and private profits give a true index of social benefit," M. Mathew, *Economics of Public Expenditure*, Vora and Co., Bombay, 1972, p. 206.

Shadow prices can be estimated either on the basis of opportunity cost or through the mathematical technique of linear programming.

10. Due and Friedlaender, *op. cit.*, p. 170. 11. Musgrave and Musgrave, *op. cit.*, p. 170.

QUESTIONS

1. "Cost-Benefit analysis is a general methodology which has been developed to make sound expenditure decisions by the public authority." Examine this statement.
2. Explain the theoretical framework of cost-benefit analysis as an aspect of public finance.
3. Make an evaluation of the usefulness of benefit-cost approach for appraisal of investment proposals.