UNIT 6 ECONOMIC APPRAISAL

Objectives

The objectives of this unit are:

- to understand the concept and scope of economic appraisal,
- to study the social cost-benefit analysis technique,
- to study the application of social cost-benefit technique in project appraisal,
- to examine the role of non-financial constrains in project appraisal.

Structure

6.1 ASPECTS OF ECONOMIC APPRAISAL

Economic appraisal of a project deals with the impact of the project on economic aggregates. We may classify these under two broad categories. The first deals with the effect of the project on employment and foreign exchange and second deals with the impact of the project on net social benefits or welfare.

6.2 EMPLOYMENT EFFECT

While assessing the impact of a project on employment, the impact on unskilled and skilled labour has to be taken into account. Not only direct employment, but also indirect employment should be considered. Direct employment refers to the new employment opportunities created within the project and first round of indirect employment concerns job opportunities created in projects related on both input and output sides of the project under appraisal. Since indirect employment is to be counted, additional investment needed in projects with forward and backward linkage effects also should be counted. Total employment effect (direct and indirect) is.

$$Z^T_C = \frac{JO^T}{I^T}$$

where

Z^T_c = total employment effect.

JO^T = total number of new job opportunities.

I^T = total investment (direct and indirect)

6.3 FOREIGN EXCHANGE EFFECT

A Project may be export oriented or reduce reliance on imports. In such cases an analysis of the effects of the project on balance of payments and import substitution is necessary. The assessment of project on the country's foreign exchange is done in two stages; first, balance of payments effects of the project and second, imports substitution effect of a project. For this purpose, net foreign exchange flows are calculated as per the proforma in statement 1. The proforma enabled the analysis of liquidity of a project in terms of foreign exchange. The annual net flows as well as net impact over the economic life of the project have to be found.

Statement 1
Proforma for Estimate of Foreign-Exchange Flows of a Project
(In foreign exchange)

Item	Year					
	0	1	2	3	4	5
I. Foreign-exchange inflows (FI)						
A. *Direct inflow*						
1. Foreign equity capital						
2. Term loan						
3. Foreign aid or grant						
4. Goods or equipment on Deferred payment						
5. Exports of goods or Services						
6. Other						
B. *Indirect inflow*						
(for linked projects)						
7. Capital						
8. Terms loans in cash and in kind						
9. Foreign aid or grant						
10. Export of goods or services						
11. Others						
II. Foreign exchange Outflows (FO)						
A. *Direct outflow*						
12. Survey, technical consultancy, engineering fees						
13. Import of capital goods,equipment, machinery, replacements.						
14. Import of raw materials, Components, parts and semi finished goods						
15. Imported goods purchased from domestic market						
16. Construction and installation charges						
17. Direct charges on imports of raw materials, Intermediates and replacements						
18. Salaries payable in foreign exchange						
19. Repayment of term loans						
20. Royalty, know-how and patent rights						
21. Repatriation of profits and capital						
22. Others						

B. *Indirect outflow (for linked projects)*

23. Import of capital goods, equipment, machinery.
24. Import of raw materials, intermediates and replacements.
25. Imported goods purchased from domestic market
26. Others

III. **Net foreign-exchange flow (I-II)(positive +, negative -)**

FE_0	FE_1	FE_2	FE_3	FE_4	FE_5

The import substitution effect of a project measures the estimated savings in foreign exchange owing to the curtailment of imports of the items of production of which has been taken up by the project. CIF values are used in calculation of import substitution effect.

Net foreign exchange effect of the project includes the net foreign exchange flow in part III statement 1 and the import substitution effect.

The analysis of net foreign exchange effect may be done for the entire life of the project or on the basis of a normal year. If two of more projects are compared on the basis of their net foreign exchange effect, the annual figure should be discounted to their present value.

6.4 SOCIAL BENEFIT ANALYSIS

6.4.1 Objectives

Another aspect of economic appraisal is social cost-benefit analysis. Cost benefit analysis is concerned with the examination of a project from the viewpoint of maximization of net social benefit. While cost-benefit analysis originated to evaluate public investment, it is also used in project appraisal. Earlier, project appraisal covered only private costs and benefits, at present, social costs and benefits are also reckoned.

Cost-benefit appraisal of a project proposes to describe and quantify the social advantages and disadvantages of a policy in terms of a common monetary unit. An enterprise or project adopting cost benefit analysis approach has, as its objective function, net benefits to society whereas the objective function of a private project is net private benefit or profit. Net social benefit entails that gains and losses be valued in a common unit. The unit should reflect society's strength of preference for each outcome. The economist uses as a measure of this preference, the consumer's willingness to pay (WTP) for a good. This will be reflected in the price he pays, though not fully.

In many cases the prices are not observable or are distorted. In these circumstances cost-benefit analysis must seek surrogate prices or shadow prices to measure what the society would be willing to pay if there is a market? Net social benefits are found by deducting from benefits (WTP) compensation required (cost). Social costs and benefits and private costs and benefits differ because of market imperfections, externalities and income distribution.

6.4.2 Market Imperfections

Private costs and profits reflect social costs and benefits only under perfect competition. Since markets were largely regulated and prices were administered earlier in our country, resources used by private sector were underpriced. The recent phenomenon of deregulation, which has freed several resources prices from control, may lead in future to near approximation of conditions in perfect competition. For instance, foreign exchange rate is now determined by markets. Since 1991, the interest on debentures is not fixed by government. In several markets regulation and administrated prices are being lifted.

6.4.3 Externalities

The difference between private costs and benefits and social costs and benefits arises mainly because of economic effects a transaction has on third parties. The effects may be benefits or costs. A project, for instance, when it creates infrastructural facilities like roads, the area adjacent may be benefited. Such benefits are, however, not included in assessing the benefits arising out of the project. Actually, such benefits are invariably underprovided and subsidies may have to be paid to ensure their provision.

On the other hand, a project may have harmful environmental effects. Such costs are not internalized and not paid for by consumers or producer. As a result, costs are imposed on society, which are not accounted for. The activity in question may also be over-extended.

The problem of externalities relating to environmental effects received impetus from the thesis propounded by World Bank that prudent environmental policies may often make poor countries less poor. Not only is sound environmental policy essential for durable development but many of the policies that improve the environment will also strengthen development. They are also powerfully re-distributive since it is often the poor that suffer from environmental degradation.

The cure for poverty is development. Development may also cure some kinds of pollution. Given the right technologies, developing countries can decouple some kinds of pollution from economic growth with beneficial effects on the economy.

6.4.4 Redistribution

Strictly from the viewpoint of the promoter or owner, it is of no consequence as to how the project’s benefits are distributed among society. But to society or government, it is essential to have information as to who benefits from the investment in various projects. For instance, industrial projects are put forward and promoted whether in private or public sector to alleviate poverty and improve income distribution. All our five-year plans have poverty alleviation as their basic objective. It is, however, not appreciated that the provision of opportunities through industrial projects cannot be availed of by the poor. The poor are unskilled and illiterate and do not have the skills that factory type of employment demands. To benefit the poor, emphasis should be on provision of opportunities through Grih Udyog (cottage industry) or rural cooperatives an on repetitive tasks which demand little skill, such as textile printing, assembly and agro-material processing. The structure of investment should not be to elongate the productive process or make it indirect. Our plans have not been able to relieve poverty because projects promoted are of the factory type. They are not suitable for integrating poor into market oriented activity.

6.5 PROJECT CHOICE

So far, it has been shown that cost-benefit analysis proceeds on the explicit basis that a project or policy is deemed socially worthwhile if its benefits exceed the costs it generates. The appropriate formula for expressing the social worth whileness of a project has not been discussed in detail, nor have guidelines been offered for assisting the choice among alternative projects. Lastly, constraints on the objective function have not been incorporated.

The Choice Context

The necessary condition for the adoption of a project is that discounted benefits should exceed discounted costs. This rule can be stated as:

$$GPV(B) > GPV(K)$$

or

$$NPV(B) > 0$$

where GPV(B) refers to the **'GROSS PRESENT VALUE'** of benefits, and NPV(B) refers to the **'NET PRESENT VALUE'** of benefits, so that

$$NPV(B) = GPV(B) - GPV(K)$$

The present values are calculated at the relevant social discount rate. A social discount rate may be considered equivalent to the 'opportunity cost' of public investments. It can also be seen in terms of an accounting price which reflects the society's trade-off of the present benefits against the future benefits. Formulated in this way, the 'worth' of a project is expressible as a unique absolute magnitude, with costs and benefits measured in the same units. In practice, however, the rule will require some modification in the light of the constraints on the objective function and allowances for risk and uncertainty.

The types of choice facing the decision-maker can be classified as follows:

i) **Accept-reject.** Faced with a set of independent projects and no constraint on the number which can be undertaken, the decision-maker must decide which, if any, is worth while. The decision rule should enable him to accept or reject each individual project.

ii) **Ranking.** If some input, such as capital, is limited in supply it may well be that all 'acceptable' projects cannot be undertaken. In this case, projects must be ranked or ordered in terms of that objective function. The decision rule for accept-reject situations cannot be easily generalised to cover these situations.

iii) **Choosing among exclusive projects.** Frequently, projects are not independent of each other. One form of interdependence exists when one project can only be undertaken to the exclusion of another project- e.g. two different ways of achieving the same objectives. The projects are then 'mutually exclusive' and the decision rule must enable the decision-maker to choose between the alternatives.

A special case of mutual exclusion exists when any given project can be undertaken now or in a later period. There is a problem in choosing the optimal point in time to start the project. This is the problem of 'time-phasing' and, once again, the decision rule should offer guidance on this issue.

6.6 NET PRESENT VALUE AND INPUT CONSTRAINTS

Since constraints on the resource available for investment are always present in the public sector, it is worth looking a little closer at the effect of such constraints on the net present value rule. The problem is to rank projects in

order of preference and to select the optimal combination of projects such that the total combined cost exhausts the budget. It is tempting to think that ranking by NPVs will achieve this result, but it does not. Consider the following simple example.

Project	**Cost** (K)	**Benefits** (B)	B-K	B/K
X	100	200	100	2.0
Y	50	110	60	2.2
Z	50	120	70	2.4

Suppose a capital constraint of 100 exists and that the constraint operates only for the one year in which capital expenditure is incurred. Ranking by NPV gives the ordering X, Z, Y so that X would be the only project selected, net benefits being 100 and the budget being exhausted. But inspection of the table shows that Y and Z could be adopted, with a combined NPV of 130 for the same cost.

To avoid this problem, projects should be ranked by their benefit-cost ratios-i.e. by GPV/K, at the predetermined discount rate.

6.7 INTERNAL RATE OF RETURN

The present value requires the use of some predetermined discount rate to discount future benefits and costs. An alternative rule is to calculate the discount rate, which would give the project a NPV of zero, and then to compare this 'solution rate' with the pre-determined social discount rate. In other words, the benefit and cost streams are presented in equation form:

$$\sum_{t=1}^{T} \frac{Bt}{(1+i)^t} = K_o$$

where *i* is the rate of discount which solves the equation, and we continue to assume that all capital costs are incurred in the initial period.

The rate *i* is given various names: the 'solution rate', the 'yield', the 'internal rate of return' and the 'marginal efficiency of investment' (or of capital, though the latter is confusing given that we are dealing with changes in the capital stock). Once *i* is determined, the rule for accept-reject and for ranking is to adopt any project which has an internal rate of return in excess of the predetermined social discount rate. As with the NPV rule, then it remains essential to choose some acceptable discount rate.

One minor drawback of the IRR approach is that the solution rate cannot be computed quickly. The reason is simply that the IRR is the solution to a polynomial equation. Thus, if the 'life' of the projects is *T* years, the problem is to find *i* in the equation

$$\frac{B_1}{(1+i)^1} + \frac{B_2}{(1+i)^2} + ... + \frac{B_n}{(1+i)^T} = K_o$$

Solutions will not be obvious and the usual approach is to proceed in an 'iterative' fashion, guessing at the likely rate and entering various rates into the equation untill two sides of the equations are equal.

The IRR is further complicated when used to compare mutually exclusive projects. It is not necessarily the case that the best project is the one with the highest IRR. Consider the two projects in Table 6.1, *X* and *Y*, each with a life of ten years.

Table 6.1

Project	Cost	Benefits (p.a.)	IRR	NPV at 8%
X	1	0.2	15%	0.34
Y	2	0.36	12%	0.42
'Y-X'	1	0.16	9%	__

On the IRR rule, X is preferred to Y, but on the NPV rule, Y is preferred to X. The IRR rule is misleading here since it discriminates against Y because of the size of the capital outlay. To avoid this problem it is necessary to calculate the rate of return on the hypothetical project 'Y-X'-i.e. on the difference between the capital outlays. Since the IRR on Y-X is in excess of the subjective rate of 8 percent, used in the example, the larger project is to be preferred to the former.

Thus the mutually exclusive context requires a two-part rule to the effect that a project Y be accepted if and only if

$$i_y > r$$

and

$$i_{(y-x)} > r$$

where *i* is the IRR and r the predetermined rate. The rule is usually described as the 'incremental yield' approach, or Fisher's 'rate of return over cost'; originating, as so much of investment theory has, with Irving Fisher's The Theory of Interest.

Present Value versus Internal Rate of Return

A very considerable literature has been devoted to the relative merits of the two approaches so far described. The consensus appears to favour the adoption of present value rules, at least for public investment decisions. The reasons for dissatisfaction with the IRR approach are numerous:

i) **Sensitivity to Economic Life:** Where projects with different economic lives are being compared, the IRR approach will possibly inflate the desirability of a short-life project, the IRR being a function both of the time periods involved and the size of capital outlay. NPV, on the other hand, is not affected by absolute magnitudes of outlay. Thus, Rs.1 invested now has an IRR of 100 percent if it cumulates to Rs.2 at the end of the year. Compare this to a Rs.10 investment, which cumulates to Rs.15:i.e. an IRR of 50 percent, but a NPV of Rs.5. The IRR rule would rank the former project above the latter.

ii) **Sensitivity to Time Phasing of Benefits:** Frequently projects may not yield benefits for many years (dams, nuclear power stations) they have long 'gestation' periods. The IRR will tend to be lower on such projects when compared to projects with a fairly even distribution of benefits over time, even though the NPV of the former project may be larger. The problem here is essentially the same as that in (i) above: IRR will give ranking to projects which 'bunch' the benefits into the early part of their economic lives relative to other projects.

iii) **Mutual Exclusivity:** It has already been noted that IRR needs to be supplemented by an additional rule in situations of mutual exclusion.

iv) **Administrative Acceptability:** The argument is sometimes advanced against NPV and in favour of IRR that decision-makers are familiar with the idea of a rate-of-return, even if they were previously used to wrong concepts, such as undiscounted returns-to-cost percentage ratios. This problem is not a serious one, however, and can be overcome by suitable expositional aids for decision-makers. The NPVs rule, on the other hand, may require that a range of NPVs be indicated, corresponding to the range of probabilities. Clearly, decision-makers in search of unique answers may find the prospect more frustrating.

v) **Multiple Roots:** In computing the IRR it is quite possible to obtain more than one solution rate. The reason for this is simple, once it is realised that the IRR is the solution to a polynomial equation. If the polynomial is of degree n, there will be n roots, i.e. n solution rates. Clearly, if a project has two situations, say 10 percent and 15percent, and the social discount rate is 12percent, there appears to be no clear-cut criterion for acceptance or rejection. This objection is considered by many to preclude the use of IRR as a decision rule.

vi) **Change in the Discount Rates:** It has been argued that the social discount rate may change over time. The calculation of a unique IRR in these circumstances would not permit of an easy comparison. Thus the IRR many be 15 percent, with the social discount rate rising from, say 12 to 18 percent over the project life. No simple criterion of acceptability exists in these circumstances. The NPV rule, however, does enable discount-rate changes to be incorporated easily into the calculation.

Overall, then, the balance of favour is with the net present value rule for deciding upon projects. The circumstances in which rate of return rules are misleading may not be many or widespread, but they are significant enough to indicate that the problems are best avoided by the use of the more straightforward present value criterion.

6.8 OTHER CRITERIA

Although most practical cost-benefit analyses use the IRR or NPV normalisation procedure, it is sometimes the case that alternative approaches are used. This section looks briefly at these rules.

i) Annual Value or 'annuity' approach. Given a stream of money benefits B_1, B_2, …, B_n, these benefits have a present value, PV(B). Corresponding to the stream of benefits will be an annuity, A_B, which, when discounted, will have the same present value as $B_1 + B_2 \ldots + B_n$, so that $PV(A_B) = PV(B)$. Similarly, there will be an annuity corresponding to the stream of costs, A_K, so that the decision rule is:rank by A_B-A_K. Clearly, from the definition of the annuity, the result cannot differ from the present value rule.

ii) Payback, a rule, which has little, or nothing to recommend it but which is still widely used, especially in private industry. The rule is simple. Establish some maximum acceptable time horizon, T*, by which, if benefit flows do not cover all cost flows in the period, the project is rejected: i.e. accept it if

$$\sum_{t=0}^{t=T^*} (B_t - C_t) > O$$

Clearly, the rule makes no allowance for projects with long gestation periods, the selection of T* usually being arbitrary. The failure to discount net benefit

flows ignores the argument for social discount rates. Indeed, payback implies a zero discount rate to T* and an infinite rate thereafter.

iii) Benefit-cost ratios. One of the most popular decision rules particularly in the early years of applied cost-benefit analysis, was the use of benefit-cost ratios. The general rules become:

i) Accept a project if $\frac{GPV\,(B)}{K} > 1$

ii) In face of rationing, rank by the ratio GPV(B)K.

iii) In choosing between mutually exclusive projects, select the project with the highest ratio.

There are numerous difficulties with this rule. One fundamental point is that no rule should be sensitive to the classification of a project effect as a cost rather than a benefit, and vice versa. Thus, all costs can be treated as negative benefits and all benefits as negative costs. For the NPV rule it should be obvious that the outcome will be the same however the division is made. But the benefit-cost ratio rule will be affected by this division since it will affect the magnitudes which are entered as denominator and as numerator. Thus if a project has (discounted) benefits of 10, 20 and 30 units, and costs of 10 and 20, the benefit-cost ratio is 2.0. But if the cost 0f 10 is treated as negative benefit, the ratio becomes 50/20=2.5. On the other hand, benefits minus costs (i.e. NPV) remains the same, at 30 units, regardless of the transfer.

Apart from being sensitive to the classification of costs and benefits, the ratio rule is incorrect when applied to mutually exclusive contexts. Thus, a project costing 100 units, with discounted benefits of 130, has a NPV of 30. This is to be preferred to a project costing 40 with benefits of 60, a NPV of 20. But in ratio terms, B is preferred since B has a ratio of 1.5 compared to A's 1.3.

6.9 NON-FINANCIAL CONSTRAINTS

As one writer has remarked, ' Economic policy is rarely concerned with the attainment of the best of all possible worlds. Rather, it seeks to improve economic welfare in the face of constraints'. Public investments are usually subject to constraints other than purely budgetary ones. Clearly, any public investment agency works with a limited overall budget, and this in turn is constrained in part by the total public expenditure budget. The latter can be altered by changes in general policy concerning the investment-consumption allocation pattern, and will itself be constrained by anti-cyclical policies, measures to deal with the balance of payments, and so on. The allocation to department will depend upon the social priorities established by the government of the day, so that budgetary constraints can themselves be thought of as being largely politically determined. In short, a government social welfare function will be in operation in respect of the allocation of funds to departments. If this welfare function is well defined, the cost-benefit analyst need not be sub-optimising when dealing with project selection within a budget constraint. Thus, investment in a new hospital may have as its opportunity cost a new education establishment. If funds have been 'properly' allocated, however, there should be no possibility of the hospital. In practice, of course, government welfare functions are not so well defined, nor could they be in the absence of unique measures of comparability between diverse outcomes such as 'health' and 'education'.

At the level of ranking project within a sub-budget, however, political constraints still operate. Some projects may never come to the attention of the analyst

because they have been 'screened out' for political reasons. This screening process may be perfectly 'efficient' if it reflects higher-level political objectives such as income-class equity, or regional balance. It seems a useful rule then to require that 'constraints … should be determined at an appropriately high political level. Effectively what happens then is that the constraints become part of the objective function, which is no longer, defined solely in terms of 'efficiency benefits'. But there may be a tendency to accept un-questioningly constraints imposed at lower levels of the political hierarchy. The reason for acceptance is usually that it greatly simplifies the problem, often eliminating complete directions of policy. The problem, however, is that once the analysts himself question the constraints he appears to be overstepping the bounds of his predefined function. This is the problem met before-with equity considerations, with normative discount rates and now with the acceptance or otherwise of political constraints. It is general problem of defining the limits of advice, of finding the dividing line between adviser and decision-maker.

6.10 SUMMARY

Whenever a new project is started it has both internal and external impact. Internal impact is specific to the firm an agency which is setting up the project, i.e. increase in cash flows etc. The external impact is the influence of the project on the economy as a whole, the employment generation, taxes and duties paid to government. import substitution, export generation etc. Another area where any project has an impact is social cost of the project. Sometimes the projects have an positive social cost and sometimes negative e.g. toxic affluents generated by industries. Therefore while selecting a project not only the financial consideration has to be taken in account but also the overall impact it has on economy as a whole has to be take into consideration.

6.11 SELF ASSESSMENT QUESTIONS

1) Make an economic appraisal of "Prime Ministers Rural Road Project."
2) Make an social cost benefit analysis of Golden Quadrangle National Highway Project.
3) List out the various factors you will take into consideration while doing a social cost benefit analysis for only project.

6.12 FURTHER READINGS

Dasgupta A.K. and D.W. Pearce, *"Cost-Benefit Analysis"*, Macmillan, London.

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