CHAPTER THREE
ECONOMIC APPRAISAL OF PROJECTS (ANALYSIS)

3.1 **Overview of Economic Analysis**

Social Cost Benefit Analysis (SCBA), also known as economic analysis, is a methodology developed for evaluating investment projects from the point of view of the society (or economy) as a whole. In the economic analysis of projects, we are interested in the total return or productivity or profitability to the whole society or economy of all the resources committed to the project. In economic analysis, the focus is on social costs and benefits of a project which tends to differ from financial analysis.

Economic analysis is used primarily for evaluating public investments; SCBA has received increasing emphasis in recent years in view of the growing importance of public investments in many countries, particularly in developing countries, where governments are playing a significant role in economic development. SCBA is also relevant, to a certain extent, to private investments, as these have now to be approved by various governmental and quasi-governmental agencies that bring to bear larger national considerations in their decisions.

In the context of planned economies, SCBA aids in evaluating individual projects within the planning framework which spells out national economic objectives and broad allocation of resources to various sectors. In other words, SCBA is concerned with tactical decision making within the framework of broad strategic choices defined by planning at the macro level. The perspectives and parameters provided by the macro level plans serve as the basis of SCBA which is a tool for analysing and appraising individual projects.

3.2 Identification of Cost and Benefits of Economic Analysis

Basically, the procedures followed and the criteria used (NPV, IRR, BCR) are the same in economic and financial analysis of projects. But the values, which the NPV, IRR and BCR assume, are different in economic analysis and financial analysis. The main factors, which explain this difference, are:

1. The items considered as inputs and outputs of the project;
2. The prices used in the valuation of inputs and output
3. The treatment of taxes, subsidies and other transfer payments.

1. Items considered as inputs and outputs

Often, some real costs and benefits attributed to projects do not appear among its inputs and outputs when it is analyzed from the enterprises viewpoint and, therefore, they do not enter the calculations of financial NPV, IRR, and benefit cost ratio. The main reason for excluding certain cost and benefits is that they are considered “external” to the enterprise. But costs or benefits viewed as “external” to the enterprise are “internal” when they are considered from the economy’s angle; somebody pays for these “external” costs and somebody receives these “external” benefits, even if it is not the enterprise. Consequently, to the extent that they can be measured and valued they are included in the calculations of the economic NPV, IRR, and BCR.

Good example of externalities is the costs incurred in providing the project area with infrastructure inputs, e.g.; access roads, energy lines, sewerage services; although these inputs are required by the project, often they serve other purposes too. Similarly, flood control benefits, for example, resulting from a hydroelectric power dam are real benefits to down stream farmers and the economy, but cannot be captured by the power authority for various reasons.

An externality, also referred to as an external effect, is a special class of good, which has the following characteristics:

(i) It is not deliberately created by the project sponsor but is an incidental outcome of legitimate economic activity.

(ii) It is beyond the control of the persons who are affected by it, for better or for worse.

(iii) It is not traded in the market place.

An external effect may be beneficial or harmful. Examples of beneficial external effects are:

- An oil company drilling in its own fields may generate useful information about oil potential in the neighboring.
- The approach roads built by a company may improve the transport system in that area.
- The training programme of a firm may upgrade the skills of its workers thereby enhancing their earning power in subsequent employments.

Examples of harmful external effects are:

- A factory may cause environmental pollution by emitting large volumes of smoke and dirt. People living in the neighborhood may be exposed to health hazards and put to inconvenience.
- The location of an airport in a certain area may raise noise level considerably in the neighborhood.
- A highway may cut a farmer's holding in two, separating his grazing land and his cowsheds, thereby adversely affecting his physical output.

Since SCBA seeks to consider all costs and benefits, to whomsoever they may accrue, external effects need to be taken into account. The valuation of external effects is rather difficult because they are often intangible in nature and there is no market price, which can be used as a starting point. Their value is estimated by indirect means. For example:

- The benefit of information provided by the oil field to neighboring oil fields may be equated with what the neighboring oil fields would have spent to obtain such information.
- The value of better transport provided by the approach roads may be estimated in terms of increased activities and benefits derived there from
- The benefit from the training programme may be estimated in terms of the increased earning power of workers.
- The cost of pollution may be estimated in terms of the loss of earnings .as a result of damage to health caused by it and the cost of time spent for coping with unhygienic surroundings.
- The cost of noise may be inferred from the differences in rent between the noise-affected area and that of some other area, which is comparable except for the level of noise.

- The harmful external effect of the highway may be measured by the consumer willingness to pay for the output of farmer, which has been reduced due to the highway.

The above examples serve to emphasize the difficulties in measuring external effects. [In view of this, some economists have suggested that these effects be ignored. In order to justify their suggestion, they argue that since a project is likely to have both beneficial and harmful external effects, one may not err much in assuming that the net effect would be zero. This argument, seemingly a rationalization for one's ignorance, lacks validity.] External effects must be taken into account wherever it is possible to do so. Even if these effects cannot be measured in monetary terms, some qualitative evaluation must be attempted.

2. **Prices used**

Another difference between financial and economic analysis is that even inputs and outputs "internal" to both the enterprise and the economy are valued differently. In financial analysis the rule is to value inputs and outputs at actual market prices, at the same time in economic analysis shadow or Efficiency or Accounting prices are employed. Consequently, using different prices will give different economic and financial NPV, IRR, and BCR even if the inputs and outputs are identical in physical terms. For example, the enterprise will have to pay workers the market wages in real Birrs (not in shadow ones), irrespective of what is believed to be their opportunity cost from the economy's viewpoint. Similarly, the enterprise will collect for its exports the equivalent of local currency calculated at the official exchange rate, even when it is believed that the foreign currency is undervalued. Again, in financial analysis it is the actual expenditure and revenue, which matter, not shadow ones.

Market prices, which form the basis for computing the monetary costs and benefits from the point of view of project sponsor reflect social values only under conditions of perfect competition, which are once in a blue moon, if ever, realized by developing countries. When imperfections are obtained, market prices do not reflect social values.

The common market imperfections found in developing countries are: (i) rationing, (ii) prescription of minimum wage rates, and (iii) foreign exchange regulation. Rationing of a commodity means control over its price and distribution. The price paid by a consumer under rationing is often significantly less than the price that would prevail in a competitive market. When minimum wage rates are prescribed, the wages paid to labour are usually more than what the wages would be in a competitive labour market free from such wage legislations. The official rate of foreign exchange in most of the developing countries, which exercise close regulation over foreign exchange, is typically less than the rate that would prevail in the absence of foreign regulation. This is why foreign exchange usually commands premium in unofficial transactions.

3. Taxes, subsidies and other transfer payments

The other reason why financial and economic NPV and IRR might differ emanates from the treatment of taxes, subsidies and other transfer payments. This issue relates to the valuation of inputs and outputs discussed above, but it is treated separately because of its importance in practice. Taxes and customs duties from which the enterprise is not exempted are taken as cost in financial analysis although they do not reflect commitment of real resources; for this reason

they are excluded from the calculations of the economic NPV and IRR. Similarly, subsidies paid to the enterprises by the government are viewed as transfer payments and are excluded from consideration in economic analysis, but they are treated like any other revenue of the enterprise in computing the financial NPV or IRR or BCR.

In addition to the factors discussed above, the impact of the project on savings, its effect on redistribution, and the consideration for merit goods are also seen as the other factors that entail differences between financial and economic analysis of projects:

i. **Concern for Savings**: Unconcerned about how its benefits are divided between consumption and savings, a private firm does not put differential valuation on savings and consumption. From a social point of view, however, the division of benefits between consumption and savings (which leads to investment) is relevant, particularly in capital-scarce developing countries. One Birr of benefits saved is deemed more valuable than a birr of benefits consumed. The concern of society for savings and investment is properly reflected in SCBA wherein a higher valuation is placed on savings and a lower valuation is put on consumption

ii. **Concern for Redistribution**: A private firm does not bother how its benefits are distributed across various groups in the society. The society, however; is concerned about the distribution of benefits across different groups. One Birr of benefit going to a poor section is considered more valuable than a Birr of benefit going to an affluent section.

iii. **Merit wants** refer ***to goals and preferences that are not expressed in the market place.*** These goals and preferences are believed by *policymakers to be in the larger interest*. For example, the government may prefer to promote girls education. This is not sought by consumers in the market place. Merit wants are not relevant from the private point of view. But they are important from the social point of view.

For the reasons discussed above the financial and economic analysis of a project will show a different picture, particularly as regards the NPV, IRR, and BCR. In analyzing public projects in particular both the financial analysis and the economic analysis should be conducted. This is especially user-to view a project from various angles and to obtain different perspectives. Decision makers need both profiles in order to evaluate a project and to design the necessary fiscal and monetary measures to meet its financial requirements.

In deciding on the acceptance or rejection of such projects, the economic criterion is superior to the financial one, and when a project passes the economic test it is an acceptable project for the country. It should be implemented provided that the government will take the necessary financial and other measures to ensure its smooth operation. A project, for example, that shows very low, or even negative financial returns as a result of the fact that the major benefits it generates are “external” to and cannot be captured by the enterprise, could show acceptable economic returns when these benefits are considered as “internal” to the economy and are valued accordingly. In this case the solution is to subsidize the enterprise sufficiently so that it will stay in operation and generate these benefits. However, although this is the economically rational approach, one should be careful with projects that pass the economic test but fail the financial test. The project analyst explaining the pass/fail situation with projects that pass/fail the financial

and economic test should present convincing data and justification. in such a way that one can feel more comfortable.

3.3 Determining Economic Values

Two principal approaches to SCBA have emerged in the late 1960s and early 1970s:the UNIDO approach and the Little and Mirrlees approach.

We shall investigate the two approaches briefly in the following part.

a. **The UNIDO Approach**

The UNIDO approach to SCBA involves five stages, each stage of which measures the desirability of the project from a different angle:

1. Calculation of financial profitability of the project measured at market prices.
2. Obtaining the net benefit of project measured in terms of shadow or economic (efficiency) prices.
3. Adjustment for the impact of the project on savings and investment.
4. Adjustment for the impact of the project on income distribution.
5. Adjustment for the impact of project on merit goods and demerit goods whose social values differ from their economic values.

The measurement of financial profitability of the project in the first stage is similar to the financial analysis we have discussed in, second chapter of the course; hence, no need to dwell into it here.

Stage two of the UNIDO approach is concerned with the determination of the net benefit of the project in terms of economic (efficiency) prices, also referred to as shadow prices. Market prices represent shadow prices only under conditions of perfect markets, which are almost invariably not fulfilled in developing countries. Hence, there is a need for developing shadow prices and measuring net economic benefit in terms of these prices.

3.3 Shadow Pricing

3.3.1 Basic Concepts and Issues of Shadow Pricing

Before we deal with shadow pricing of specific resources, certain basic concepts and issues must be discussed: choice of nume'raire, concept of tradability, source of shadow prices, treatment of taxes, and consumer willingness to pay.

1. *Choice of Numeraire*: Just as it is a great convenience to express market prices in terms of money, so it will be appropriate to measure shadow prices all in terms of a unit of account, which is called the numeraire. in economic analysis the value of inputs and outputs is expressed using this numeraire, or unit of account. In the UNIDO approach 'aggregate consumption expressed in domestic prices' is used as the unit of account; i.e., inputs and outputs are measured in terms of domestic prices that is used as a numeraire. In the Little and Mirrless approach, 'uncommitted social income measured in border prices' is the unit of account; i.e, values are expressed in terms of border prices that is used as the numeraire.

2. *Concept of Tradability*: A key issue in shadow pricing is whether a good is tradable or not. For a good that is tradable, the international price is a measure of its opportunity cost to the country. Why? For a tradable good, it is possible to substitute import for domestic production

and vice versa; similarly it is possible to substitute export for domestic consumption and vice versa. Hence the international price, also referred to as the border price, represents the 'real' value of the good in terms of economic efficiency.

3. **Sources of Shadow Prices -** The UNIDO approach suggest three sources of shadow pricing, depending on the impact of the project on national economy. A project, as it uses and produces resources, may for any given input or output (i) increase or decrease the total consumption in the economy, (ii) decrease or increase production in the economy, (iii) decrease imports or increase imports, or (iv) increase exports or decrease exports.

If the impact of the project is on consumption in the economy the basis of shadow pricing is consumer willingness to pay. If the impact of the project is on production in the economy, the basis of shadow pricing is the cost of production. If the impact of the project is on international trade - increase in exports, decrease in imports, increase in imports, or decrease in exports, and the basis of shadow pricing is the foreign exchange value.

4. **Taxes** when shadow prices are being calculated, usually pose difficulties. The general guidelines in the UNIDO approach with respect to taxes are as follows: (i) When a project results in diversion of non-traded inputs which are in fixed supply from other producers or addition to non-traded consumer goods, taxes should be included. (ii) When a project augments domestic production by other producers, taxes should be excluded. (iii) For fully traded goods, taxes should be ignored.

3.3.2 Shadow Pricing of Specific Resources

a. Tradable Inputs and Outputs: A good is fully traded when an increase in its consumption results in a corresponding increase in import or decrease in export or when an increase in its production results in a corresponding increase in export or decrease in import. For fully traded goods, the shadow price is the border price, translated in domestic currency at the market exchange rate.

The above definition of a fully traded good implies that domestic changes in demand or supply affect just the level of imports or exports. This means for an imported good, the following conditions should be met: (i) If there is an import quota, it is not restrictive. (ii) The import supply is perfect1y elastic over the relevant range of import volume. (iii) There is no surplus capacity in the domestic industry; all additional supply must be imported. If there is surplus domestic capacity it cannot be utilized for want of necessary inputs. (iv) If the additional demand exists inland, the imported goods, even after taking into account the cost of transport from the port of entry to the point of inland demand, cost less than the marginal cost of local production; (v) The imported input costs less than the domestic marginal cost of purchase.

When the above conditions are satisfied, additional demand will be met fully by external trade. Hence the input is considered fully traded. Similar conditions must be satisfied for importable outputs, exportable inputs, and exportable outputs, if they are to be considered fully traded. In practice, it is reasonable to regard tradable inputs and outputs as fully traded, even if the above-mentioned conditions are not fully satisfied.

A good is not traded if it is tradable but conditions (i) through (iv) above are not fulfilled. For non-traded goods the border price does not reflect its economic value. What then is the value of non-traded goods? The value of a non-traded good should be measured in terms of what domestic consumers are willing to pay, if the output of the project adds to its domestic supplies or if the requirement of the project causes reductions of its consumption by others. The value of a non-traded good should be measured in terms of its marginal cost of the project causes reduction of production by other units.

b. **Non-tradable Inputs and Outputs** A good is non-tradable when the following conditions are satisfied: (i) its import price (CIF price) is greater than its domestic cost of production and (ii) its export price (FOB price) is less than its domestic cost of production.

The valuation of non-tradable is done as per the principles of shadow pricing discussed earlier. On the output side, if the impact of the project is to increase the consumption of the product in the economy, the measure of value is the marginal consumers' willingness to pay; if the impact of the project is to substitute other production of the same non-tradable in the economy, the measure of value is the saving in cost of production. On the input side, if the impact of the project is to reduce the availability of the input to other users, their willingness to pay for that input represents social value; if the project's input requirement is met by additional production of it, the production cost of it is the measure of social value.

Labour Inputs: The principles of shadow pricing for goods may be applied to labour as well, though labour is considered to be service. When a project hires labour, it could have three possible impacts on the rest of the economy: it may take labour away from other employments; it may induce the production of new workers; and it may involve import of workers.

When a project takes labour away from other employments, the shadow price of labour is equal to what other users of labour are willing to pay for this labour. In a relatively free market this will be equal to the marginal product of such labour.

The social cost associated with inducing 'additional' production of workers consists of the following: (i) the marginal product of the worker in the previous employment - if the worker is previously unemployed, this would naturally be zero; (ii) the value assigned by the worker on the leisure that he may have to forego as a result of employment in the project -the value of this leisure is reflected in his reservation wage; (iii) the additional consumption of food when a worker is fully employed as opposed to when he is idle or only partly employed; (iv) the cost of transport and rehabilitation when a worker is moved from one location to another; (v) the increased consumption by the worker and its negative impact on savings and investment in the society when the worker is paid market wage rate by the project; and (vi) the cost of training a worker to improve his skills.

The social cost associated with import of foreign workers is the wage they command. In this case, however, a premium should be added on account of foreign exchange remitted abroad by these workers from their savings.

Capital Inputs When a capital investment is made in project two things happen: (i) financial resources are converted into physical assets. (ii) Financial resources are withdrawn from the national pool of savings and hence alternative projects are foregone. Thus, shadow pricing of capital investment involves two questions:

- What is the value of physical assets?
- What is the opportunity cost of capital (which reflects the benefit foregone by sacrificing alternative project/s)?

The value (shadow price) of physical assets is calculated the value of other resources is calculated. If it is a fully traded good, its shadow price equal to its border price. If it is a non-traded good its price is measured in terms of cost of production (if the project induces additional domestic production of the asset) or consumer willingness to pay (if the project takes the asset from other users).

The opportunity cost of capital depends on how the capital required for the project is generated. To the extent that it comes from additional savings, its opportunity cost is measured by the consumption rate of interest (which reflects the price the saver must be paid to sacrifice present consumption); to the extent that it comes from the denial of capital to alternative projects, its opportunity cost is the rate of return that would be earned from those alternative projects. This is also called the investment rate of interest. In practice, the consumption rate of interest may be used as the discount rate because in stage three of UNIDO) analysis an inputs and outputs are converted into their consumption equivalents.

There are, however, problems in determining the consumption rate of interest empirically. So the UNIDO approach recommends a 'bottom up' procedure. As per this procedure, the project analyst calculates the internal rate of return of a project and presents the project to the planners (or politicians) who are the decision makers. If the project is accepted, the analyst may assume that the planners judge the consumption rate of interest to be more than the internal rate of return. On the basis of a repetitive application of this process, the range for estimated consumption rate of interest can be sufficiently narrowed for practical use, provided, of course, the planners on the top are consistent.

Foreign Exchange The UNIDO method uses domestic currency as the nume'raire. So the foreign exchange input of the project must be identified and adjusted by an appropriate premium (as discussed below). This means that valuation of inputs and outputs that were measured in border prices has to be adjusted upward to reflect the shadow price of foreign exchange.

3.3.5 Border Parity Pricing

If the domestic price of inputs a project uses is far higher than under conditions of free trade, a project that uses the protected input may have a low financial NPV. On the other hand, if a project produces a good that enjoys protection, the project's financial NPV may be higher than under conditions of free trade. So the market prices need to be adjusted to reflect the real economic values of tradable inputs and outputs.

In almost all cases, the economic benefits of producing tradable outputs and costs of using tradable inputs are measured by the **border price of these inputs and outputs**. **The**

opportunity cost of tradable goods is defined by their border prices. The e**fficiency/shadow prices are border prices determined by international trade. The project inputs and outputs are thus valued on the basis of international trade. The basic assumption here is that international market is less distorted than the domestic market and thus taking international price is more realistic to value the true cost of inputs and outputs**.

World prices are normally measured as border prices reflecting the value of a traded good at the **border or port of entry (airport or sea port) of a country**. ***Border price is the unit price of a traded good at a country's border or point of entry***. **Border prices are either CIF or FOB prices suitably adjusted for internal transport and other costs, but net of taxes and subsidies.**

It is to be recalled that values in project financial statements will normally be at prices received by the project - ex - factory or farm gate prices or paid by the project for inputs. To move from market to shadow price analysis therefore, shadow prices must be **expressed in terms of world prices to the project**. This means that for traded goods ***domestic margins, relating to transport and distribution (including port handling) will have to be adjusted to prices at the border to obtain values at the project level.*** The decomposition of these margins is referred to as **border parity pricing**. ***A parity price or parity economic value*** **is the price or value of a project input & output that is based on a border price adjusted for expenses between border and the project boundary.**

The economic principle involved is that production or use of a traded good has a **dual effect**, both in terms of **direct foreign exchange** given by the border price of the good and also in terms of the **resources that go into its distribution between the project location and the border**. To assess the full economic values of a traded good in a world price system requires both **its foreign exchange worth at the border**, plus the **value at world price of the non-traded activities of transportation and distribution required per unit of output**.

Recall that for tradable goods,

1. CIF prices < Domestic market prices;
2. Fob prices > Domestic market prices.

Where a project imports an input its border parity price is the **CIF price plus transport and distribution costs up to the destination to the domestic market**. An **importable border price** is its **CIF price of imports - its price landed in the importing country before the effects of any tariffs or quantitative restrictions have been added to its price**. The **landed cost of an import on the dock or other entry point** in the receiving country includes the **cost of international freight and insurance** and often includes the **cost of unloading onto the dock**. But this **excludes any charges after the import touches the dock and excludes all domestic tariffs and other taxes or fees**. The CIF price represents the **direct foreign exchange cost of the input up to the port of entry (air port, seaport, land port (eg Moyale))**.

Similarly an exportable good should be valued at a border price or **FOB export price**. For goods that are traded directly by a project the border parity price for the project output is the **FOB price minus the value of transport and distribution**. The FOB price is the price that would be

earned by the exporter after paying any costs to get the good to the border, but before any export subsidies or taxes were imposed. These later costs must be deducted since real resources are required before the good can be exported.

The **FOB border price** should be **netted from handling, transportation and marketing expenses to arrive at the project site price or farm/factory gate price**. By subtracting these expenses one arrives at the **factory or farm gate value of the exportable output at border prices**. The FOB border price is the actual foreign exchange **earned** from exporting at the export price minus any marketing margins and transport costs to get the good from the project site to the border.

If the project does not actually import or export the goods concerned but produces that save imports (import substitutes) and uses domestic goods that could have been exported (exportable) or could have been imported (importable) the adjustment is less straight forward.

The reason for using border prices to measure the economic value of a project's tradable inputs can be understood in terms of the assumption that the **international markets are comparatively competitive and free of distortions**. The international price paid for goods and services will be a good measure of the increase in welfare created from consuming the foreign exchange earned by producing a particular tradable goods or service.

3.3.6 **National Parameters and Standard Conversion Factors**

In computing border parity prices, we used official exchange rate (OER) to convert the border prices into local currency. This procedure assumes that OER is appropriate to make the two prices comparable. Border prices of tradable goods valued at foreign currency and non-tradable services (like local transportation) valued in domestic currency are two prices of two categories of goods. Can they be made comparable? If yes how? These are the two relevant questions. In a way we are talking not of two types of goods, but two types of cost components of one type of tradable good. This cuts across both categories of goods, the tradable and non-tradable goods.

There are some important parameters that have general applicability in the sense that they are used in all projects. These parameters should take the same value in all projects although they can change from time to time. In other words, such parameters are national in that they apply to all projects regardless of their sector, and they are economic because they reflect the **shadow price of the items concerned**.

For instance, a typical list of national economic parameters may cover conversion factors for:

• Unskilled and skilled labor

• Some of the main non-tradable sectors

• Some aggregate conversion factors such as consumption conversion factor, a standard average conversion factor, the discount rate, Shadow foreign exchange rate, etc.

A project analyst can apply these parameters directly to the project under analysis. They are called **national parameters to distinguish them from the project specific shadow prices**. They are estimated by central planners and are taken as given by the project analyst. How many parameters should be estimated depends upon the economic conditions of the country and the

degree of sophistication desired in project analysis. However, a minimum of the following national parameters should be estimated:

- The standard conversion factor;
- The shadow exchange rate
- The shadow wage rate; and
- The discount rate;.

A Conversion Factor

A conversion factor is defined as the factor by which we multiply the actual price in the domestic market of an input or output to arrive at its economic/accounting/ price when the latter cannot be observed or estimated directly. The more the inputs and outputs are traded the less will be the need to use conversion factors. **The conversion factor is simply the ratio of the shadow price of the item to its market price**. **A conversion factor is estimated simply by taking the ratio of border prices (world prices) to domestic market prices of the good.** The conversion factor for any item 'i' is defined as: **CFi = SPi/ MPi**

Where SPi is the shadow price for the item in question and MPi is the market price.

The market distortions vary from commodity to commodity, therefore, the conversion needed varies from case to case. It is therefore possible to estimate conversion factors for commodity specific, service specific, or sector specific (like electricity, transportation, construction etc.,) or for a basket of goods (e.g. consumption goods for a particular income group), depending on the **degree of aggregation desired**. Thus conversion factors can be calculated at different levels:

• For individual commodities. **E.g**. coffee conversion factor
• For broad sector example: construction conversion factor
• For categories of expenditure. Example investment conversion factor
• For the **economy as a whole example Standard Conversion Factor (SCF)**.

In all cases one is comparing a value at world price, which should reflect the shadow price, with the domestic price.

In principle we should have one conversion factor for each non-tradable commodity or for each group of commodities whose markets have similarities. However, this is very difficult and we have to resort to some kind of aggregation despite the shortcomings associated with aggregates. Thus the use of conversion factor is only the second best approach. The best approach is to use the accounting price.

Thus for homogenous groups of goods and services it is convenient to have readily available conversion factors to be used in all projects, instead of decomposing them every time a project is analyzed.

The question now is how many conversion factors do we need? There is no definite answer to the question. It all depends on:

1. The data availability,
2. The variations of market distortions,
3. The time it takes to estimate conversion factors, etc.

In practice if data permits some five conversion factors covering major inputs of most projects will suffice. But at least we need one conversion factor to multiply all the domestic market prices of all non- traded components of the input and output of a project. **This parameter is called the standard conversion factor**.

The Standard Conversion Factor

This is an all-inclusive conversion factor used in place of commodity - or sector- specific conversion factors, either because they cannot be estimated accurately, or because we believe that they cannot be estimated accurately or because they do not differ substantially from the standard conversion factor. **It is a summary measure to calculate accounting prices for non-tradable commodities.**

In the case of Ethiopia the standard conversion factor is interpreted as a summary and approximate quantification of the distorted markets (domestic) as compared to the international market. It is therefore estimated as the **ratio of the value of imports and exports of a country at border prices (CIF and FOB) to their value at domestic prices**.

Where M and X are total imports and exports respectively **at world prices converted at the official exchange rate**.

$$SCF = \frac{M + X}{(M + T_m - S_m) + (X + S_x - T_x)}$$

- T_m and T_x are the total **trade taxes** on imports and exports respectively
- S_m and S_x are total **trade subsidies** on imports and exports respectively

All values should refer to the same year or to an average over the same period. As pointed out earlier the SCF is a summary measure to calculate accounting prices for non-tradable goods. This is achieved by multiplying the net of taxes domestic price of the commodity by the SCF. The border price is obtained by multiplying the net of taxes domestic price of the commodity by the SCF.

Thus every effort must be made to decompose the non-tradable goods into traded and non-tradable elements and apply the SCF only to the latter. The rule for the non-tradable goods should be still decomposition and the SCF should be used only when this is impossible, very difficult or is not worth the effort. The SCF is revised from time to time by the central economic authorities and adopted by planning bodies.

The premium on foreign exchange and the Shadow Exchange Rate

The official exchange rate, OER, will be equal to the true economic value placed on foreign exchange if it is able to move freely without intervention or control by the government and if there is no rationing of foreign exchange, no tariffs or non- tariff barriers on imports and no taxes or subsidies on exports. In countries where these conditions hold the market price of foreign exchange, the OER, should be a good measure of people's willingness to pay for the foreign exchange needed to buy imported inputs and the economic benefit the local economy receives from any foreign exchange earnings made by a project.

In many developing and developed countries, there are many distortions in the market for foreign exchange and traded goods. The market for foreign exchange may be strictly controlled and it may only be possible to purchase foreign exchange for permitted purposes. These controls will often be imposed because the fixed official exchange rate is overvalued, which results in the demand for foreign exchange greatly exceeding supply. A currency is overvalued if the official exchange rate understates the amount of domestic currency that residents of the country would be willing to pay for a unit of foreign currency, such as one dollar US, if they could freely spend it on duty-free goods - goods sold at their border prices. Obviously, in most countries, people would pay more for foreign currency if they could spend it freely on duty-free goods without having to travel internationally to do so. Most currencies in the world are therefore overvalued in this sense, with the exception of those of duty-free economies like Hong Kong and Singapore. Trade distortions such as import tariffs and quotas therefore result in a country's currency being overvalued.

If the official exchange rate, OER, expressed in terms of units of local currency needed to buy one unit of foreign exchange is fixed below the appropriate level it is said to be overvalued. This means that an unrealistically high value is placed on the local currency in terms of how much foreign exchange can be bought with a unit of currency.

Countries that have an overvalued exchange rate are said to place a premium on foreign exchange, or to have a foreign exchange premium. A foreign exchange premium, FEP, measures the extent to which the OER understates the true amount of local currency that residents would be willing to pay for a unit of foreign exchange, or its true opportunity cost to an economy. The FEP can be measured crudely by the ratio of the value of total trade, imports plus exports, valued in domestic prices and therefore including the effect of tariffs and other distortions, to the value of trade in border prices, minus one, as given in the equation below:

$$FEP = \left[\frac{M(1+t) + X(1-d+s)}{M+X}\right] - 1 * 100\%$$

where

- t are the tariffs, or tariff equivalents of non-tariff barriers, imposed on imports
- d are the export tax equivalents of any restraints and taxes imposed on exports
- s are the export subsidy equivalents of any support given to encourage exports
- M is the value of imports in border prices, (CIF)
- X is the value of exports in border prices, (FOB).

The numerator of this ratio measures the total amount in local currency that residents are actually paying to consume imports, including tariffs and taxes, plus the amount they are actually accepting for exports, excluding export taxes and including export subsidies. It therefore measures the true value put on traded goods consumed and produced by the country. The denominator of the ratio in the above equation shows the actual foreign exchange value of these traded goods when they are measured at their border prices, converted into local currency at the OER. The ratio of the domestic value to the border price value of trade therefore shows the true

value placed on traded goods, relative to apparent economic value at the official exchange rate. The FEP is usually expressed as a percentage, so the ratio of value of trade in domestic prices to its value in border prices, minus one, is multiplied by 100. The FEP therefore shows the extra percentage local residents would be willing to pay for foreign exchange, above the official exchange rate, if they were able to buy currency freely and spend it on duty- free goods.

When estimating the economic prices of tradable in countries that have an overvalued exchange rate, it will not be correct to merely value traded goods (which may normally be subject to a tariff) at their border prices and then convert these values to local currency at an artificially low official exchange rate. Such a process would make them appear unrealistically cheap compared with locally produced non- traded goods. This is because the local price of non-traded goods will, over time, have adjusted upwards to equal the tariff inclusive price of traded goods, which consumers find equally attractive. Given a choice between a US dollar's worth of imported goods, valued at their tariff-free border price and converted to local currency at the official exchange rate, and a US dollar's worth of locally produced non-traded goods, valued at their domestic market price, the average consumer would prefer a dollar's worth of duty-free imported goods. The foreign exchange required to purchase these imported goods will therefore have a higher value to the local consumer than is indicated by the official exchange rate, OER. In this situation, the project analyst must correct for these distortions in the market for foreign exchange and traded goods that result in a premium being placed on foreign exchange.

Almost all projects include a mixture of traded and non-traded inputs and outputs. If no correction is made for this premium on foreign exchange in economic appraisals, projects that produce traded good outputs will yield an NPV that is undervalued, compared with those producing non-traded goods. This occurs because the traded good outputs would be valued at their fob (or cif) border prices, converted into local currency at the artificially low official exchange rate, in terms of local currency per $US. On the other hand, projects that use imported inputs will appear to have low costs when the border prices of these inputs are converted at the OER and will therefore have a NPV that is overvalued compared with projects using non-traded good inputs.

If a foreign exchange premium exists, it is therefore necessary to take account of it in all projects where both traded and non-traded goods and services are included among project inputs and outputs, or when comparing projects producing or using traded and non-traded goods and services. If both traded and non-traded commodities are used or produced in a project, they need to be valued in comparable prices before they can be added together in the net cash flow of the project. The reason for this can be seen from the following simple example. Assume that in a particular economy there are only two homogeneous consumer products produced and consumed. One is a non-traded good, housing, and the other is a traded good, automobiles. The average equilibrium price for both houses and automobiles in the domestic market is Br. 100 000. At this price, consumers are just as indifferent to purchasing more automobiles as to more housing, since both are equally valuable to them. However, automobiles are subject to a 100 per cent tariff and are sold on the international market for only $US 10 000, or Br.50 000 (converted

at the OER of Br. 5 to $USl). Since automobiles are the only goods traded (imported) by this economy, from the equation above, the foreign exchange premium will be:

$$FEP = \left[\frac{100000}{50000} - 1\right] \times 100 \text{ per cent} = 100 \text{ per cent}$$

In this country, two alternative projects are being considered: one a housing construction program and the other an automobile factory. When an economic appraisal is made of the auto factory, if no account is taken of the foreign exchange premium, automobiles, which are traded goods, would be valued at their border price, Br. 50 000 per automobile. On the other hand, an economic analysis of the housing construction program would value housing, a non-traded good, at its local free market equilibrium price, Br. 100 000 per house. If the two projects had the same level of input costs per unit of output and the same project life, the housing construction program would appear to have the higher net present value. It would therefore be selected in preference to the automobile project if only one of two projects could be undertaken.

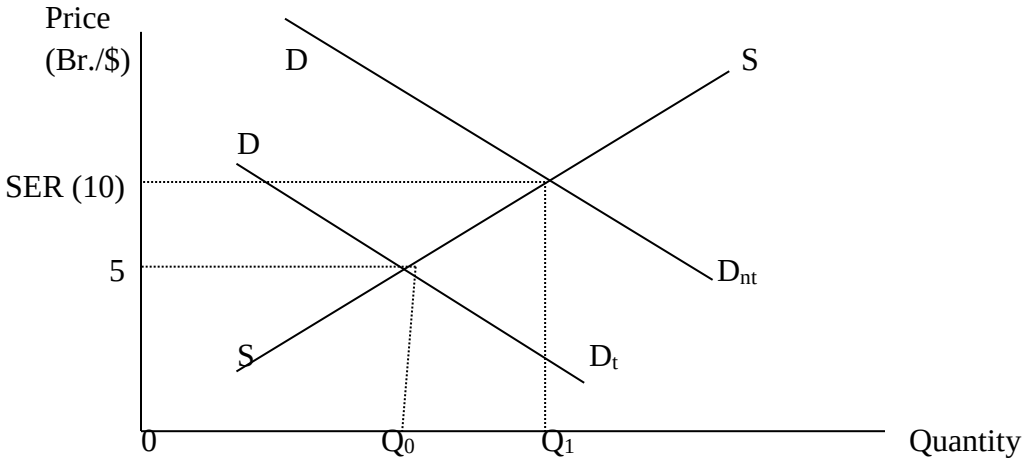

Fig. Demand and Supply of Foreign Exchange with no trade distortions

However, if the tariff were removed from automobiles and local residents could buy them for Br.50 000 each, domestic demand for cars would increase strongly. As there is only one traded good in this economy, at every exchange rate the demand for foreign exchange would rise, as can be seen from the figure above. The demand curve for foreign exchange, DD_t would move out to DD_{nt}, the tariff-free demand curve for foreign exchange and demand for foreign exchange would expand from Q_0 to Q_1. As a result, if the OER were allowed to float freely it would devalue increasing the units of local currency received for each US dollar of foreign exchange earned. This would encourage producers to export more and earn more foreign exchange, to the point where demand for and supply of foreign exchange would again be equal. In the figure above this occurs at an exchange rate of Br. 10 / $US1. At this new distortion-free equilibrium exchange rate, the border price of automobiles would rise to Br. 100 000 and their economic price would in fact equal the price of the non-traded housing.

Alternatively, if the project were designed to export automobiles, these could be sold for $US 10 000 of foreign exchange per automobile. If we continue the assumption that there is only one traded good in the economy, the foreign exchange would be used to import more automobiles for which people would be willing to pay Br. 100000. On the other hand, the project might produce automobiles that could be sold locally in competition with imported automobiles, also for Br.100 000 per automobile. The $US 10 000 of foreign exchange earned for each exported automobile from the project would actually have a value of Br.100 000 to the economy at local market prices. Thus, in this one-traded-good economy, the true value of each $US1 of foreign exchange earned would be Br. 10, not Br. 5. The results of this simple example can be used to show how the SER of the economy is calculated.

The shadow exchange rate, SER, is the foreign exchange rate that reflects the true economic value placed on foreign exchange in an economy. In an economy with no trade or foreign exchange market distortions the SER would be the equilibrium exchange rate. However, if distortions remain in the market for foreign exchange, the shadow exchange rate will be different. One way of correcting for an overvalued exchange rate in project appraisal is to use a shadow exchange rate, rather than the official exchange rate to value all foreign exchange earned and used by the project.

A simple definition of a country's SER involves addition of the percentage FEP to the OER, or more precisely, multiplication of the OER by one plus the FEP divided by 100:

$$SER = OER\ x\ \left[\frac{FEP}{100} + 1\right]$$

In our example of the two-good economy, with a FEP of 100 per cent, the shadow exchange rate can be estimated by:

$SER = {}^{Br.5}/_{\$US1}\ x\ \left[\frac{100}{100} + 1\right] = {}^{Br.10}/_{\$US1}$ The shadow exchange rate would therefore be ${}^{Br.10}/_{\$US1}$. So foreign exchange in fact has twice the value indicated by the official exchange rate.

From the definition of the foreign exchange premium, the SER can also be defined as:

$$SER = OER\ x\ \frac{\text{value of trade in domestic prices}}{\text{value of trade in border prices}}$$

$$SER = OER\ x\ \left[\frac{M(1 + t) + X(1 - d + s)}{M+X}\right]$$

Where

X,M, t, d and s are as defined earlier

If the country imports 100 cars and its tariff on cars is 100 per cent, its SER will equal:

$$SER = \frac{Br.\ 5}{\$US1}\ x\ \frac{100\ x\ \$10000\ x\ (1+1)}{100\ x\ 10000}$$

$$SER = \frac{Br.\ 10}{\$US1}$$

In this simple formula for measuring the SER, the OER is inflated by the ratio of the full amount people are actually willing to pay for traded goods in domestic market prices, to the value of these goods in border prices converted at the OER. The SER will always be higher than the OER, in terms of the local currency units people will pay for a unit of foreign exchange, if the value of traded goods in domestic prices, including taxes and tariffs is higher than their value in border prices (assuming export taxes do not outweigh import tariffs).

The Shadow Exchange Rate in the UNIDO Approach

In a similar fashion to the discussion presented above, the UNIDO (Guidelines) method determines the shadow price of foreign exchange on the basis of marginal social value as revealed by the consumer willingness to pay for the goods that are allowed to be imported at the margin. The shadow price of a unit of foreign exchange is equal to:

$$\sum_{i=1}^{n} Fi\ Qi\ Pi$$

Where:

Fi = Fraction of foreign exchange, at the margin, spent on importing commodity i

Qi = Quantity of commodity i that can be bought with one unit of foreign exchange (This will be equal to 1 divided by the CIF value of the good in question).

Pi = domestic market clearing price of commodity i

Example:- Commodities 1,2,3, and 4 are imported at the margin. The proportion of foreign exchange spent on them, the quantities that can be bought per unit of foreign exchange, and the domestic market clearing prices are as follows:

F1 = 0.3, F2 = 0.4, F3 = 0.2, F4 = 0.1

Q1 = 0.6, Q2 = 1.5, Q3 = 0.25, Q4 = 3.0

P1 = 16, P2 = 8, P3 = 40, P4 = 5

The value of a unit of foreign exchange is:

(.3) (0.6) (16) + (0.4) (1.5) (8) + (02) (0.25) (40) + (0.1) (3.0) (5) = Br. 13.180

The calculation of the shadow price of foreign exchange in terms of consumer willingness to pay is based on the assumption that the foreign exchange requirement of a project is met from the sacrifice of others. The use of foreign exchange by a project, however, may also induce the production of foreign exchange through additional exports or import substitution. In such a case, the shadow price of foreign exchange would be based on the cost of producing foreign exchange, not consumer willingness to pay for foreign exchange.

One common misconception is that an economy's shadow exchange rate is equivalent to its black market foreign exchange rate. As only a small residual proportion of the total foreign exchange earnings of a country are traded in the black market and there are risks involved in illegal transactions, the black market rate will typically be above the undistorted equilibrium exchange rate, but may be lower than the SER if exchange controls and trade distortions stay in place. The smaller the risks involved and the greater the proportion of foreign exchange traded on the black market the closer will be the black market rate to the distortion-free equilibrium exchange of a currency.

The traditional method employed in cost benefit analysis to take account of the foreign exchange premium that was used in the 'UNlDO Guidelines' is to value all traded and non-traded goods and services in terms of domestic price equivalents. Domestic prices are used as the numeraire or common unit of account, in terms of which all project inputs and outputs are valued. For this reason, the UNIDO approach is sometimes known as the domestic price approach.

The project's traded good inputs and outputs are firstly valued in their fob and cif border prices. They are then converted from foreign currency to local currency using a shadow exchange rate, SER, rather than the official exchange rate, OER. This is done to better reflect the true economic value of foreign exchange to the economy.

In a situation where the local currency is overvalued and the foreign exchange premium is positive, the ratio of the shadow exchange rate to the official exchange rate will be greater than one (when both are expressed in terms of units of local currency per dollar of foreign exchange). Use of a shadow exchange rate to convert the border prices of traded goods into local prices will have the effect of inflating these border prices until they equal the amount that people are willing to pay, or receive, for traded goods. These inflated traded goods prices will then reflect the true value placed on traded goods vis-à-vis non-traded goods. As these traded goods will now be valued in domestic price equivalents they will be directly comparable with the project's non-traded inputs and outputs valued in domestic prices.

When using the domestic price approach, a project's non-traded inputs and outputs are simply valued in their domestic prices. As indicated earlier, adjustments should first be made to the prices of non-traded goods to ensure that they reflect the true marginal social costs and benefits of consuming and producing these goods. This will be done by including consumers' surplus, but excluding producer surplus, and deducting transfers where appropriate. No additional adjustment is made to non-traded goods prices to reflect their overvaluation in relation to traded goods, the foreign exchange premium, as this would involve double counting. Both traded and non-traded goods will then be valued in comparable, domestic price equivalents and it will therefore be possible to add them together in the project's cash flow.

The domestic price approach therefore corrects for the FEP by inflating the border price values of traded goods, using the economy's estimated SER, until these values correctly reflect the goods' relative worth compared with the domestic prices of non-traded goods.

In summary, the domestic price approach values:

Traded goods	Non-traded goods
@ Border price x SER	@ Domestic prices
⇓	
Domestic price equivalent	

Numeraire: domestic prices

Practical Examples using the UNIDO approach

(i) Imported input

Table 1 below illustrates how the economic value of a project's imported textile inputs will be measured using the UNIDO approach. It has been estimated that the country has a foreign exchange premium of 30 per cent and the shadow exchange rate is therefore (1 +0.3) x OER. All tariffs and taxes are deducted from the domestic retail price of textiles and their tradable (foreign exchange) component is inflated by the shadow exchange rate to obtain the domestic price equivalent of the cif import price. The economic cost of domestic transport and handling is then added.

Table1: Valuation of imported textile inputs using the UNIDO approach
(Millions of Br.)

	Financial Cost	Economic Cost
CIF import price (@ OER)	250	
(@ SER = 1.3 x OER)		325
Import Tariff (40 Per Cent)	100	0
Internal Transport	50	50
Handling and Distribution*	50	20
Total	450	395

Ratio of Economic Value to Financial Value = $\frac{395}{450} = 0.88$

*60 per cent of these 'costs' represent rents earned from privileged access to foreign exchange, and are therefore not included in the economic cost of handling and distribution

(ii) Exported output

Table 2 below gives an example of the economic valuation of a project's exported garment output, using the UNIDO approach. The country again has a foreign exchange premium of 30 per cent. The foreign exchange earnings are inflated by the shadow exchange rate and all export subsidies are deducted from the fob export price to obtain the domestic price equivalent of the border price.

Table 2: Valuation of exported garment output using the
UNIDO approach ($'000)

	Financial Cost	Economic Cost
FOB output value (@ OER)	1200	-
(@ SER = 1.3 x OER)	-	1560
Export Tax (10 Per Cent)	-120	0
Transport to port* (including 50 percent fuel tax)	-40	-30
Total	1040	1530

Ratio of Economic Value to Financial Value = $\frac{1530}{1040}$ = 1.47

*The market price of transport includes a 50 per cent fuel tax. Since fuel equals half of total transport costs its economic value = 40 - (40 x 0.5 x 0.5) = 30

(iii) Non-traded input

The domestic price approach to the valuation of a non-traded input such as electricity is shown in Table 3 below. The financia1 cost of the electricity is its domestic sales price, Br.2 million, plus Br. 300 000 sales tax. If the non-traded input's supply can be increased, its economic value will be measured by its domestic market supply price, after any adjustments have been made for market imperfections such as taxes, price fixing, subsidies or monopoly pricing. If the project uses electricity that must be bid away from existing consumers, then the electricity should be valued at the price that people are willing to pay for it, its demand price.

In the example above, electricity is a private monopoly and monopoly rents are found to represent Br. 500000 of the total Br. 2 Million supply price of electricity. If the project uses electricity that must be bid away from existing consumers, then the monopoly rents should be included when measuring its economic value, as people are willing to pay this total amount, including these rents for this electricity. Monopoly rents are only treated as a transfer and excluded if the supply of electricity can be expanded to meet the project's needs. In this case only the cost to the economy of producing additional electricity is the relevant economic cost.

Of the project's total electricity input requirements, 40 per cent will be met by displacing existing consumers and 60 per cent will be met by expanding supply. The economic cost of this displaced consumption is the total amount that people were willing to pay for this electricity, including monopoly rents and sales tax. Approximately Br.200 000 (40 per cent of Br. 500 000) of the monopoly rents should therefore be included in the economic value of the input, but the remaining Br. 300 000 should not be included. Similarly, approximately 40 per cent of the sales tax (Br.120 000) should be included in the economic value of the input, the part that is met by displacing existing consumers, but the remaining Br. 180 000 of sales tax should not be included in the project's economic costs.

Table 3: Valuation of 1 gigawatt of electricity input using the UNIDO approach (Br. '000)

	Financial Cost	Economic Cost
Domestic Sales price (before tax)	2000	-
Cost of new production	1200	900*
Cost of displaced consumption: Of which monopoly rents are:	800 (500)	800 (200)
Sales Tax	300	120
Total	2300	1820

Ratio of Economic Value to Financial Value = $\frac{1820}{2300}$ = 0.79

*The economic cost of newly produced electricity; is obtained as (2000 x 0.6) - (500 x 0.6) = 1200 - 300 = 900, since that part of monopoly rents that is earned on newly produced electricity is only a transfer

(iv) Non-traded output

If instead the project is producing electricity a non-traded output, the UNIDO approach to valuing this electricity is as shown in the Table 4 below. If the entire project's output meets new demand its economic value is simply its domestic market demand-price, as long as there is no price fixing or rationing. In this case all new output represents an increment in supply. Consequently, all monopoly rents and sales taxes imposed should be included in measuring the economic benefits of the project, as this is the amount people are willing to pay for the electricity. The electricity authority does not receive the sales tax paid on electricity, so it is not a financial benefit to it.

Table 4: Valuation of 1 gigawatt of electricity output using the UNIDO approach (Br. '000)

	Financial Cost	Economic Cost
Domestic Sales price: Of which monopoly rents are:	2000 (500)	2000 (500)
Sales Tax*	0	300
Total	2000	2300

Ratio of Economic Value to Financial Value = $\frac{2300}{2000}$ = 1.15

*Sales tax is included as an economic benefit because the country's government will receive the tax revenue even though the electricity authority will not

Impact on Distribution

Stages three and four of the UNIDO method are concerned with measuring the value of a project in terms of its contribution to savings and income redistribution. To facilitate such assessments, we must first measure the income gained or lost by individual groups within the society.

Groups: For income distribution analysis, the society may be divided into various groups. The UNIDO approach seeks to identify income gains and losses by the following: Project, Other private business, Government, Workers, Consumers, and External Sector There can, however be, other equally valid groupings.

Measure of Gain or Loss: The gain or loss to an individual group within the society as a result of the project is equal to the difference between the shadow price and the market price of each input or output in the case of physical resources or the difference between the price paid and the value received in the case of financial transaction.

Example1: Farmers in a certain area use 1 million units of electricity generated by a hydro-electric project. The benefit derived by them, measured in terms of the willingness to pay is

equal to Br. 0.4 million. The tariff paid by them to the electricity board is Br. 0.25 million. So the impact of the project on the farmers gain of Br. 0.15 million. (0.4-0.25million)

Example2: A mining project requires 1000 laborers. These laborers are prepared to offer themselves for work at a daily wage rate of Br. 8.00. (This represents their supply price.) The wage rate paid to the laborers, however, is Br. 10 per day. So the redistribution benefit enjoyed by the group of 1000 laborers is Br. 2000 (1000 x (10 – 8) per day.

Savings impact and its value

Most of the developing countries face scarcity of capital. Hence, the governments of these countries are concerned about the impact of a project on savings and its value thereof. Stage three of the UNIOO method, concerned with this and seeks to answer the following questions: Given the income distribution impact of the project what would be its effects on savings? What is the value of such savings to the society?

Impact on Savings: The savings impact of a project is equal to:

$$\Sigma \Delta Y_i MPS_i$$

where ΔY_i= change in income of group i as a result of the project.

MPS_i = marginal propensity to save of group i

Example As a result of a project the change in income gained/lost by four groups is:

Group 1 = Br. 100000; Group 2 = Br. 500000; Group 3 = Br. –200000; and Group 4 = Br. -400000. The marginal propensity to save of these four groups is as follows:

MPS1 = 0.05; MPS2= 0.10; MPS3 = 0.20; and MPS4 = 0.40.

The impact on savings of the project is thus given by:

100,000 X 0.05 + 500,000 X 0.10 - 2 00,000 x 020 – 400,000 x 0.40 = -Br. 1 45000.

Impact on Income Distribution

Many governments regard redistribution of income in favor of economically weaker sections or economically backward regions as a socially desirable objective. Due to practical difficulties in pursuing the objective of redistribution entirely through the tax, subsidy, and transfer measures of the government, investment projects are also considered as investments for income redistribution and their contribution toward this goal is considered in their evaluation. This calls for suitably weighing the net gain or loss by each group, measured earlier, to reflect the relative value of income for different groups and summing them.

Adjustment for merit and demerit goods

In same cases, the analysis has to be extended beyond stage four to reflect the difference between the economic value and social value of resources. This difference exists in the case of merit goods and demerit goods. A merit good is one for which the social value exceeds the economic value. For example, a country may place a higher social} value than economic value on production of all because it reduces dependence on foreign supplies. The concept of merit goods

can be extended to include a socially desirable outcome like creation of employment. In the absence of the project, the government perhaps would be willing to pay unemployment compensation or provide more make-work jobs.

In the case of a demerit good, the social value of the good is less than its economic value. For example, a country may regard alcoholic products as having social value less than economic value.

In order to adjust for merit or demerit goods, the following steps may be used:

1. Estimate the economic value of the project
2. Calculate the adjustment factor

$$\text{Adjustment factor} = \frac{Social\ value}{Economic\ value} - 1$$

For merit goods, the ratio of social value to economic value is greater than 1 and adjustment factor becomes positive. On the other hand, the ratio of social value to economic value is less than 1 for demerit goods and the adjustment factor becomes negative.

3. Multiply the economic value by the adjustment factor to obtain adjustment

   Adjustment = Economic value x adjustment factor
4. Compute the social value by adding adjustment to the economic value

   Social value = Economic value ± Adjustment

To illustrate the adjustment for the difference between social value and economic value of the project, assume that the present economic value of the project is Br. 10,000,000. The output of the project is merit good and its social value exceeds its economic value by 60%.

Based on the above information, the adjustment factor is computed as follows:

$$\text{Adjustment factor} = \frac{160\%}{100\%} - 1$$
$$= 1.60 - 1$$
$$= \underline{60}\%$$

Adjustment for merit good is computed as follows:

Adjustment = Economic value X adjustment factor
= 10,000,000 X 0.60
= 6,000,000

Then social value is equal to the sum of economic value and adjustment

Social value = 10,000,000 + 6,000,000 = 16,000,000

Where the socially valuable output of the project does not appear as an output in the economic analysis - as is the case where the project generates employment - the procedure is somewhat different. In such a case the output is treated like an externality and its valuation in social terms is the adjustment. While the adjustment for the difference between the social value and economic value is seemingly a step in the fight direction, it is amenable to abuse. Once the analyst begins to make adjustment for social reasons, projects which are undesirable economically maybe made to appear attractive after such adjustment. Since the dividing line between 'political' and 'social' is rather nebulous, it becomes somewhat easy to push politically expedient projects, irrespective of their economic merit by investing them with social desirability. While there is no way to

prevent such a manipulation, the stage-by-stage UNIDO approach mitigates its occurrence by throwing it in sharp relief.

Little-Mirrlees (L – M) Approach

I.M.D. Little and J.A Mirrlees have developed an approach to social cost benefit analysis of the project. The UNIDO and L-M approaches have considerable similarities between them. Some of the similarities are:

1. The calculation of shadow (Accounting) prices
2. The consideration the factor of equity
3. the use of Discounted Cash Flow (DCF) analysis

Although L-M approach and UNIDO approach are similar in some aspects, they are not without differences.

There differences are:

UNIDO Approach	L-M approach
1. Measures costs and benefits in terms of domestic Birr	1. Measures costs and benefits in terms of international (border) prices
2. Measures costs and benefits in terms of consumption	2. Measures costs and benefits in terms of uncommitted social income.
3. The analysis focuses on, efficiency, savings, and redistribution considerations in different stages	3. Tends to view efficiency, savings, and redistribution considerations together.

Shadow Pricing under L-M Approach

L-M approach classified the inputs and outputs of the project into three categories. These are

a. Tradable goods and services

The border price is considered the shadow price for a traded good or service. Assume that foreign demand and supply are perfectly elastic, the shadow price of exportable goods is Free-on-Board (FOB) price. On the other hand, the shadow price of importable good is its Cost Insurance Freight (CIF) price.

b. Non-tradable goods and services

Certain goods are not amenable to foreign trade, such as land, building, electricity, water, and transportation. Since there is no observable border price for such goods and services, their shadow (accounting) prices are defined in terms of marginal social cost and marginal social benefits.

The marginal social cost of a good is the value in terms of accounting prices of the resources required to produce an extra unit of the good. Similarly, the marginal social benefit is the value of an extra unit of the good from the social point of view.

c. Labour

According to L-M, the shadow wage rate is the function of several factors, some of which include:

- the marginal productivity of labour
- the cost associated with urbanization such as cost of transport, urban overheads etc.
- the cost of having an additional amount committed to consumption (when the consumption of the worker increases as a result of the higher income he/she enjoys in urban employment).

3.4 Cost-effectiveness Measures

Thus far we have focused on cost-benefit analysis. This technique is appropriate for projects with benefits and costs that are measurable in monetary terms. A vast class of projects generates benefits that are not easily measurable in monetary terms. If the project measures its benefits in some non-monetary unit, the NPV criterion for deciding whether to implement it cannot be used.

In such cases, economic analysis can still be a great help in project design and selection. We use it to help select among programs that try to achieve a given result, such as choosing among several methods to improve mathematical skills. Economic analysis is also useful to select among methods that have multiple outcomes. For example, three methods might be available for raising reading speed, comprehension, and word knowledge. Each method may have a different impact on each of the three dimensions and on cost. Economic analysis enables us to compare the costs of various options with their expected benefits as a basis for making choices.

Two main techniques exist for comparing projects with benefits that are not readily measurable in monetary terms: **cost-effectiveness** and **weighted cost-effectiveness**. In all cases we measure costs as shown in the previous sections. The main difference between the approaches is in the measurement of benefits. If the benefits are measured in some single non-monetary units, such as number of vaccines delivered, the analysis is called cost-effectiveness. If the benefits consist of improvements in several dimensions, for example, morbidity and mortality, then the several dimensions of the benefits need to be weighted and reduced to a single measure. This analysis is known as weighted cost-effectiveness.

The choice of technique depends on the nature of the task, the time constraints, and the information available. We would use cost-effectiveness for projects with a single goal not measurable in monetary terms, for example, to provide education to a given number of children. When the projects or interventions aim to achieve multiple goals not measurable in monetary terms, we use weighted cost-effectiveness; for example, several interventions may exist that simultaneously increase reading speed, comprehension, and vocabulary, but that are not equally effective in achieving each of the goals. A comparison of methods to achieve these aims requires reducing the three goals to a single measure, for which we need some weighting scheme.

All evaluation techniques share some common steps. The analyst must identify the problem, consider the alternatives, select the appropriate type of analysis, and decide on the most appropriate course of action. This topic provides the tools for identifying the costs and benefits and assessing whether the benefits are worth the costs.

3.4.1: Cost-effectiveness Analysis

Cost effectiveness analysis is a technique closely related to cost benefit analysis .it differs in that it asks a different question, namely given a particular objective, which is the least cost way of achieving it? It aids choice between options but cannot answer the question whether or not any of the options are worth doing. It is utilized when there are difficulties in associating monetary values with the outcomes of projects but where the outcomes can be quantified along some non-monetary dimension.

In cost-effectiveness analysis, we measure the benefits in non-monetary units, such as test scores, number of students enrolled, or number of children immunized. As an example, suppose we want to evaluate the cost effectiveness of four options to raise mathematics skills (Levien 1983):

- Small remedial groups with a special instructor
- A self-instructional program supported with specially designed materials
- Computer-assisted instruction
- A program involving peer tutoring

We first estimate the effect of each intervention on mathematics skills as measured by, say, test scores, while controlling for initial levels of learning and personal characteristics. Suppose we find that students taught in small groups attain scores of 20 points, those undergoing the self-instructional program score 4 points, those with computer-assisted instruction score 15 points, and those in the peer-tutored group score 10 points (table 9). These results show that small group instruction is the most effective intervention.

Now consider cost-effectiveness. Suppose that the cost per student is US$300 for small group instruction, US$100 for the self-instructional program, US$150 for computer-assisted instruction, and US$50 for peer tutoring. The most cost-effective intervention turns out to be peer tutoring; it attains one-half the gain of small group instruction at only one-sixth the cost for a cost-effectiveness ration of only 5 (see table 9). Cost-effectiveness analysis can also be used to compare the efficiency of investment in different school inputs.

Table 9 Hypothetical cost-effectiveness ratios for interventions to improve mathematics skills

Intervention	**Size of effect on test scores**	**Cost per student (US$)**	**Cost effectiveness ratio**
Small group instruction	20	300	15
Self-instructional materials	4	100	25
Computer-assisted instruction	15	150	10
Peer tutoring	10	50	5

Source: Levin (1983)

Cost-effectiveness ratios must always be used with caution. In the above example, peer tutoring is the most cost-effective intervention. If we have several cost-effectiveness (CE) ratios and either the numerator or the denominator have exactly the same value in all cases, CE ratio can be used safely for decision-making. CE ratios would be safe to use if the benefits had differed, but the cost per student had been the same for each intervention. If, however, both the measure of benefits – test scores in this case – and the costs per student vary among interventions, the analyst should use CE ratios with caution. In the example above computer assisted instruction produces a gain of five points over peer tutoring at an additional cost of US$100, or US$20 per point. To choose peer tutoring over computer-assisted instruction solely on the basis of CE ratios would be tantamount to saying that the marginal gain in test scores is not worth the marginal expense. When using CE ratios, we advise analysts to ask the following three questions:

- Can I increase the intensity of an intervention and improve the results?
- Can I combine interventions and improve the results?
- Is the intervention's marginal gain worth the extra cost?

3.4.2 Weighted Cost-Effectiveness

Sometimes project evaluation requires joint consideration of multiple outcomes, for example, test scores in two subjects, and perhaps also their distribution across population groups. In such situations, the analyst must first assess the importance of each outcome with respect to single goal, usually a subjective judgment derived from one or many sources, including expert opinion, policymakers' preferences, and community views. These subjective judgments are then translated into weights. Once the weights are estimated, the next step is to multiply each of the outcomes by the weights to obtain a single composite measure. The final step is to divide the composite measure by the cost of the options being considered. The results are called weighted cost-effectiveness ratios.

Application in Education

Suppose that employing better-qualified teachers raises mathematics scores more than language scores. To evaluate the two options for improving student learning, the analyst must compare the effect of each option on mathematics and language performance. The analyst could apply equal weights to the gains in test scores, but if mathematics is judged to be more important than language, policy makers may prefer to weight scores differently to reflect the relative importance of the two subjects.

Owing to the many dimensions of learning, the need for weighting may arise even when only one subject is involved. Consider the data in table 11 which show the effects of two improvement strategies for three dimensions of reading skills, as well as the weights assigned by experts to these skills on a scale of 0-10 points. Assigning the weights is the trickiest part of the

exercise; the rest of the calculation is mechanical. Dividing the weighted scores by the cost of the corresponding intervention gives the weighted cost-effectiveness ratio for comparing the interventions. At a cost of US$95 per pupil for intervention A and US$105 per pupil for intervention B, the option with the more favorable ratio is the latter.

Table 11 Weighting the outcomes of two interventions to improve reading skills

Category	Weights assigned by expert opinion	Intervention A[a]	Intervention B[b]
Reading speed	7	75	60
Reading comprehension	9	40	65
Word knowledge	6	55	65
Weighted test score [b]	n.a	1215	1395
Cost per pupil	n.a	95	105
Weighted cost-effectiveness ratio	n.a	12.8	13.3

n.a. Not applicable

a. the scores on each dimension of outcome are measured as percentile ranking

b. The weighted score is calculated by multiplying the score for reading speed, reading comprehension, and word knowledge by the corresponding weight and summing up the result. The weighted score of 1215 for intervention A equals (7x75+9x40+6x55).

Source: Adapted from Levin (1983)

Note that this procedure becomes meaningful only when the analyst scores outcomes on a comparable scale. We could not compare, say, reading speed in words per minute with reading comprehension in percentage of material understood. The reason is that the composite score would then depend on the scale used to measure the individual scores. The metric used must be the same for all dimensions being compared. One procedure is to express all the scores in terms of percentile rank, as in the earlier example. Applying the appropriate weights to the scores then provides the desired composite score.

Application in health

Weighted cost-effectiveness is also useful for assessing health projects. Going back to the immunization example considered before, the immunization interventions reduce morbidity as well as mortality. A given intervention might have different impacts on the reduction of these two indicators. To choose among several interventions would require weighting morbidity and mortality to produce a single measure of benefits. It has become increasingly common to measure and aggregate reduction in morbidity and premature mortality in terms of years of life gained.

Table 12 Benefits from interventions: years of life gained from immunization program

Category	Mortality	Morbidity	Total	Gain from DPT only	Gain from BCG only
Benefits (years)	56,000	16,992,000	17,048,00	15,127,000	1,921,000
Costs (US$ millions)	n.a	n.a	125	111	61
Cost-effectiveness ratios	n.a	n.a	7.3	7.3	31.8

n.a Not applicable

Source: Levin (1983)

Table 12 shows the costs and benefits of three interventions with the benefits calculated in terms of health years of life gained, which are calculated as the sum of the difference between the expected duration of life with and without the intervention plus the expected number of years of morbidity avoided as a result of the intervention. The analyst calculates the years of life gained from reductions in mortality and morbidity by using the same epidemiological model previously applied to calculate deaths prevented by adding the computation of cases, information on the average duration of morbidity, and years of life lost based on a life table.

Comparing option with subjective outcomes

Sometimes no quantitative data exist that relate interventions to outcomes. Suppose that we want to assess two options to improve performance in mathematical and reading, but have no data on test scores. The evaluator could first ask experts to assess the probability that test scores in the two subjects will rise by a given amount, say by one grade level, under the interventions being considered, and then weighting these probabilities according to the benefit of improving test scores in the two subjects. To elaborate, suppose informed experts judge the probability of raising mathematics scores to be 0.5 with strategy A and 0.3 with strategy B. Experts also judge the probability of raising reading scores to be 0.5 with strategy A and 0.8 with strategy B. The information is insufficient to choose between the strategies, however, because neither dominates for both subjects.

The weighted cost-effectiveness approach overcomes this difficulty by asking policymakers or other relevant audiences to assign weights to the gain in test scores. Suppose they assign a weight of 9 on a scale from 0-10 to a gain of one grade level in mathematics and a weight of 6 to gain of one grade level in reading. The score for strategy A would then be 7.5 (0.5x6+0.5x9), and the score of strategy B would be 9.0 (0.3x6+0.8x9). If strategy A costs US$375 and strategy A costs US$375 and strategy B costs US$400, then the cost-effectiveness ratio would be US$50 for strategy A and US$44 for strategy B. In this case, B could be the preferred strategy, because it is the most cost effective and generates the highest benefits.

Some important caveats

When quantitative data on the relationship between project interventions and their outcomes are available, and when only a single dimension of outcomes matters, cost-effectiveness analysis offers a systematic tool for comparison. The method does not incorporate subjective judgments. When such judgments enter into measuring project outcomes, the method is called weighted cost effectiveness analysis. The main advantage of weighted cost-effectiveness analysis is that we use it to compare a wide range of project alternatives without requiring actual data.

The reliance on subjective data gives rise to important shortcomings in weighted cost-effectiveness analysis. These shortcomings related to two questions: Who should rank the benefits of the options being considered? How should the ranking of each person or group be combined to obtain an overall ranking?

Choosing the right respondents is critical. An obvious group to consult comprises people who will be affected by the interventions. However, other relevant groups include experts with specific knowledge about the interventions and government officials responsible for implementing the options and managing the public resources involved. Given that the choice of respondents is itself a subjective decision, different evaluators working on the same problem almost invariably arrive at different conclusion using weighted cost-effectiveness analysis. The method also does not produce consistent comparisons from project to project.

Analysts must be careful when consolidating individual rankings. Preference scales indicate ordinal, rather than cardinal, interpretations. One outcome may assign a score of eight as superior to one assigned a score of four, but this does not necessarily mean that the first outcome is twice as preferable. Another problem is that the same score may not mean the same thing to different individuals. Finally, there is the problem of combining the individual scores. Simple summation may be appealing, but as pointed out in a seminal paper on social choice, the procedure would not be appropriate if there were interactions among the individuals so that their scores should really be combined in some other way (Arrow 1963). Because of the problems associated with interpreting subjective weights in project evaluation, weighted cost-effectiveness analysis should be used with extreme caution, and the weights be made explicit.