

**Project Appraisal for Developing Countries**

**I. Approaches to normative development**

**1. Economic planning**

Central planning (USSR)  
 Indicative planning (France)  
 National and State budgets (U.S.)  
 Determine: tax revenues, government expenditures, public investment.  
 Techniques: Input-Output analysis, Social Accounting Matrices, CGE models, macro models.

**2. Policy advice**

Stabilization policies. Determine: exchange rate, fiscal policy, monetary policy, wage and price control policies.  
 Adjustment policies. Determine: trade liberalization, deregulation, privatization, tax reforms.  
 Institutional reforms. Determine: property rights, land reform, regulatory policies, public institutions, legal framework.  
 Techniques: policy analysis for public policy advice, for public policy-making advice.

**3. Development projects and programs (public investments)**

- Project cycle
- Country strategy (special programming mission, country economists).
- General identification of projects: broad options (special identification mission).
- Specific identification
- Project appraisal (ex-ante)
  - Technical feasibility (engineering)
  - Financial appraisal (at market prices): private willingness to accept the project.
  - Economic appraisal (at shadow prices): true economic value of the project.
  - Social appraisal (use of welfare weights to reflect distribution goals)
  - Techniques: cost/benefit analysis, rapid appraisal
- Project implementation (project in progress)
  - Monitoring: revisions, closed-loop systems (experiments, learning, adjustments)
  - Techniques:
    - Logical framework (logframe): performance indicators at each stage of project.
    - Public expenditure tracking surveys (PETS): accounting for expenditures
    - Participatory rapid appraisal (PRA)
- Project evaluation and impact analysis (ex-post)
  - Ex-post cost/benefit analysis
  - Cost/effectiveness (benefits measured in quantities instead of values)
  - Impact analysis: attribution to the project of effects on indicators

**4. Management advice**

Public sector advice (public administration)  
 Private sector advice (consultants to firms); private investments

**II. Basic principles of project appraisal**

**1. Discount rate and present value**

- Present value of a future income = How much can you borrow today against \$100 of income next year if the interest rate is  $i$  ?

$X = \frac{\$100}{1+i}$  = present value of \$100 next year

Examples:

- if  $i = 5\%$ ,  $X = \$95$
- if  $i = 10\%$ ,  $X = \$91$
- if  $i = 25\%$ ,  $X = \$80$

$i$  = discount rate = interest rate if perfect capital market = cost at which can borrow on the capital market.

$\delta = \frac{1}{1+i}$  = discount factor

General discounting formula: present value of a future value  $F_t$  obtained  $t$  years from now:

$$PV(F_t) = \delta^t F_t = \frac{F_t}{(1+i)^t}$$

Examples of present value of \$100 of future income:

| Discount rate: $i$ (%) | Year 0 | Year 1 | Year 2 | Year 5 | Year 10 | Year 30 |
|------------------------|--------|--------|--------|--------|---------|---------|
| 0                      | 100    | 100    | 100    | 100    | 100     | 100     |
| 10                     | 100    | 91     | 83     | 62     | 39      | 6       |
| 25                     | 100    | 80     | 64     | 33     | 11      | 0.1=10¢ |

Environmental debate: "to discount or not to discount?"

Environmentalists: No. Give full value to the future.

Economists: Yes, but impose other constraints on calculus of costs and benefits as needed, e.g., sustainability constraint:  $Y_{\text{generation } T+1} \geq Y_{\text{generation } T}$

Present value of a stream of future values  $F_t$  over  $n$  years:  $PV(F) = \sum_{t=0}^n \frac{F_t}{(1+i)^t} = \sum_{t=0}^n \delta^t F_t$

Note: Constant vs. time dependent discount rate:

Hyperbolic discount rate: discount rate declines with time (decision-maker will become more far sighted in the future). Explains procrastination on decisions that imply immediate costs and delayed rewards, explains postponing actions.

**2. Criteria for project appraisal**

$B_t$  = benefit in year  $t$

$C_t$  = cost in year  $t$

$R_t$  = revenue in year  $t = B_t - C_t$

**2.1. Net present value (NPV) criterion**

$$NPV(R_t) = \sum_{t=0}^n \frac{R_t}{(1+i)^t} = \sum_{t=0}^n \frac{B_t - C_t}{(1+i)^t} = \sum_{t=0}^n \frac{B_t}{(1+i)^t} - \sum_{t=0}^n \frac{C_t}{(1+i)^t} = PV(B) - PV(C)$$

Project rule: do the project if  $NPV > 0$

**2.2. Benefit-cost ratio (BCR) criterion**

$$BCR = \frac{PV(B)}{PV(C)} = \frac{\sum_{t=0}^n \frac{B_t}{(1+i)^t}}{\sum_{t=0}^n \frac{C_t}{(1+i)^t}}$$

Project rule: do the project if  $BCR > 1$

### 2.3. Internal rate of return (IRR) criterion

$$\text{Solve } NPV(R_i) = \sum_{t=0}^n \frac{B_t - C_t}{(1+i)^t} = 0 \text{ for } i = IRR. \text{ (i.e., } IRR = i \text{ at which } NPV = 0)$$

Project rule: do the project if  $IRR > r$  (borrowing cost).

Note: There can be multiple solutions to the IRR. Hence, should use both the  $IRR > r$ , and the  $NPV > 0$  or  $BCR > 1$  criteria.

### 2.4. Comparison of projects

- For a single project, the three criteria are identical to decide on doing or not the project.
- For comparing projects: rankings based on the three criteria are not the same. Small projects may have very high IRR, but very low NPV.

If projects are mutually exclusive, use the NPV ranking as recognizes the scale of projects.

If project are not exclusive, but there is a budget constraint  $\bar{K}$ , use  $\frac{NPV}{\bar{K}}$  ranking as criterion (i.e., rate of return on  $\bar{K}$ ).

### 3. At what price to calculate NPV?

**3.1. Financial or commercial appraisal:** private value of the project. Use market prices (e.g., wage paid to workers).

**3.2. Economic appraisal:** social value of the project. Use shadow prices = social opportunity cost of the resources = return generated by these resources in the next best alternative to the project or foregone return by drawing the resource away from that next best alternative.

If perfect markets: shadow price = market price

If price distortions: shadow price  $\neq$  market price. Sources of price distortions:

- Policy distortions: import tariffs, export taxes, subsidies, taxes, minimum wage, interest controls, price controls, fixed exchange rate
- Inherent market failures: natural monopoly, externalities, transactions costs, public goods.

Typical market distortions:

- Shadow  $e >$  official  $\bar{e}$  (market  $e$  too low)  
Overvalued exchange rate due to:
  - Inflation and lagged devaluation
  - Import tariffs and quotas restricting demand for dollars
  - Fixed overvalued  $e$  and unsustainable borrowing
  - Fixed overvalued  $e$  and foreign exchange quotas

Projects that earn \$ (increase exports) or save \$ (reduce imports) are valued more at the shadow  $e$  than at the market  $e$ . Hence, social logic = do more projects for import substitution or export earnings than under private logic.

- Shadow  $w$  for unskilled labor  $<$  formal labor market  $\bar{w}$  (market  $w$  too high)

Overpriced labor due to:

- Minimum wage with unemployment
- Subsistence wage with surplus labor
- Efficiency wage (internal labor market: equilibrium with unemployment)

If there is unemployment, the shadow wage is 0 for unemployed labor categories.

Projects that use unskilled labor are valued more at the shadow wage. Hence, social logic = do more labor intensive projects than under private logic..

- Shadow  $r >$  official  $\bar{r}$  due to credit subsidies (market  $r$  too low)  
Underpriced financial capital due to interest rate controls.

Projects with low K/L ratios are valued more at the shadow interest rate. Hence, social logic = do less capital intensive projects than under private logic.

- Also: product and factor price distortions due to trade policies, tax-subsidy policies.  
e.g.: import tariff due to rent seeking. Hence, social logic = invest less in producing that commodity than under private logic.

v) If market does not exist (e.g., environmental amenity):

Use contingency valuation (willingness to pay and to accept) or travel cost (revealed willingness to pay) to establish

use value  
existence value  
option value

Difficulties with contingent valuation:

Monetizing value impossible when good is priceless for the owner: infinite price.

Difference between what people say and do: artificial experiment.

Problem of framing: answer depends on how the question is asked.

Informational problem: lack of market reduces capacity to give an answer.

- How to calculate shadow prices = undistorted market prices

Tradable goods: international price at equilibrium exchange rate with no trade distortions and no domestic subsidies

Non-tradable goods: use predicted domestic equilibrium prices for  $S = D$  with no subsidies and perfect markets.

Use parallel market (black market) prices (e.g., for exchange rate)? Yes, but include risk premium and transactions costs.

### 4. At what discount rate to measure PV?

- Financial appraisal: use the market interest rate.

- Economic appraisal: use a social discount rate  $<$  market equilibrium interest rate?

Typically: social discount rate = 2% vs. market equilibrium interest rate 10-15%

- Low social discount rate chosen to account for:

Positive externalities created by the project not included in B.

Value for future generations (sustainability) not captured by market prices.

Value of social goals not reflected in market prices:

Employment creation.

Income distribution, poverty reduction.

National security: increase self-sufficiency.

But: better discount as much as possible at market  $r$  (allowing consistency with private incentives) and

impose sustainability, distributional, and other constraints separately through taxes and subsidies.

### 5. Economic appraisal and implementation

Financial feasibility at the project level needs to be satisfied (private entrepreneur, semi-public agency, or public agency with hard budget constraint).

Need subsidize the difference between economic and financial feasibility (i.e., between shadow and market prices).

- i) If shadow  $w < \bar{w}$ : need wage subsidy to do the project equal to  $L^*(\bar{w} - \text{shadow } w)$ .
- ii) If shadow  $p > \bar{p}$ : need subsidize entrepreneurs to encourage socially wanted projects.
- iii) If shadow  $c > \text{official } \bar{c}$  ( $M$  too cheap,  $E$  under-priced): need tax  $M$  (import tariff) and subsidize  $E$ .
- iv) If shadow  $r > \bar{r}$ : need tax capital.
- v) If positive externalities: shadow cost < private cost: need subsidize the activity.
- vi) If negative externalities (pollution, congestion):: need tax the activity or impose quota on the activity.
- vi) If monopoly pricing: need regulate.

Or need remove distortions before the project is done:

- Remove policy distortions: policy reforms (e.g., “getting the prices right” through trade liberalization)
- Remove market failures: harder to do. Reduce transactions costs.

## 6. Notes on project appraisal

**1) Shadow prices are not value free:** they take the distribution of assets as given (e.g., the legitimacy of the current distribution of land). Market failures imply that prices are determined by the current distribution of assets: non-separability between efficiency and equity.

**2) Social appraisal: Use of welfare weights to reflect income distribution objectives**

$$\Delta Y = \sum_k w_k \Delta Y_k \text{ or } B = \sum_k w_k B_k$$

$w_k$  of poor groups  $> 1$ ,  $w_k$  of non-poor groups  $< 1$ . But weights are arbitrary. Can simulate alternative specifications.

**3) Choice of discount rate if there is no capital market**

$$\delta = \frac{NPV_t}{K_t} \text{ for the marginal project that exhausts } \bar{K} = \text{shadow value of capital.}$$

**4) Risky projects:** Use risk discounting (risk aversion parameter  $\lambda$ ):

$$\text{Benefit of project in year } t = R_t = E(B_t) - \lambda V(B_t)$$

## 5) Rapid appraisal

**Advantages:** Quick, low-cost approach to collect views and feedbacks of experts and beneficiaries.

**Methodology:** In-depth interviews that can be informal (fully flexible, conversational), semi-structured (interview guide as checklist), or standardized (pre-set open-ended questions).

Qualitative methods are useful complements to quantitative appraisal (dynamics (Hirschman’s “hiding hand”), complex processes, recommendations for change, identification of constraints, formulation of hypotheses about causalities identified in survey measurements).

**Limitations:** case studies not generalizable, no statistical validation, results vary with team composition.

## 6) Participatory appraisal

See <http://www.worldbank.org/poverty/impact/>

Rapid participatory rural appraisal (mapping techniques, key informant interviews, focus group discussions, community group interviews, ranking exercises, trend analysis, transect, mini-survey).

Useful to collect opinions, inner vision, client satisfaction, recommendations for change by participants. Useful to involve key players, establish ownership, increase local learning. Useful to provide timely information for management decision-making.

Participatory methods: action-research, but may alter behavior (strategic games, manipulation of information).

Need give individual safeguards (protection of human subjects)

## 7. Example of project appraisal: textile mill and telecommunications system.

### Financial and economic appraisal of development projects

|   | Years         |              |              |              |              |              | Project appraisal |             |             |
|---|---------------|--------------|--------------|--------------|--------------|--------------|-------------------|-------------|-------------|
|   | 0             | 1            | 2            | 3            | 4            | 5            | NPV(10%)          | CBR         | IRR in %    |
| <b>Project appraisal at market prices</b>   |               |              |              |              |              |              |                   |             |             |
| Textile mill  |               |              |              |              |              |              |                   |             |             |
| Wages   | 350           | 100          | 100          | 100          | 100          | 100          |                   |             |             |
| Costs in foreign exchange   | 500           | 0            | 0            | 0            | 0            | 0            |                   |             |             |
| Other costs   | 150           | 0            | 0            | 0            | 0            | 0            |                   |             |             |
| Total costs   | 1000          | 100          | 100          | 100          | 100          | 100          | 1254              |             |             |
| Revenues in foreign exchange  | 0             | 400          | 400          | 400          | 400          | 400          |                   |             |             |
| Other revenues  | 0             | 0            | 0            | 0            | 0            | 0            |                   |             |             |
| Total revenues  | 0             | 400          | 400          | 400          | 400          | 400          | 1378              |             |             |
| <b>Total revenues - Total cost</b>  | <b>-1000</b>  | <b>300</b>   | <b>300</b>   | <b>300</b>   | <b>300</b>   | <b>300</b>   | <b>125</b>        | <b>1.10</b> | <b>15.2</b> |
| Telecommunications system   |               |              |              |              |              |              |                   |             |             |
| Wages   | 100           | 50           | 50           | 50           | 50           | 50           |                   |             |             |
| Costs in foreign exchange   | 800           | 0            | 0            | 0            | 0            | 0            |                   |             |             |
| Other costs   | 100           | 0            | 0            | 0            | 0            | 0            |                   |             |             |
| Total costs   | 1000          | 50           | 50           | 50           | 50           | 50           | 1081              |             |             |
| Revenues in foreign exchange  | 0             | 0            | 0            | 0            | 0            | 0            |                   |             |             |
| Other revenues  | 0             | 350          | 350          | 350          | 350          | 350          |                   |             |             |
| Total revenues  | 0             | 350          | 350          | 350          | 350          | 350          | 1206              |             |             |
| <b>Total revenues - Total cost</b>  | <b>-1000</b>  | <b>300</b>   | <b>300</b>   | <b>300</b>   | <b>300</b>   | <b>300</b>   | <b>125</b>        | <b>1.12</b> | <b>15.2</b> |
| <b>Project appraisal at social prices: Shadow wage is 75% of market wage, so all wage costs are reduced by 25%</b>                        |               |              |              |              |              |              |                   |             |             |
| Textile mill  |               |              |              |              |              |              |                   |             |             |
| Wages   | 262.5         | 75           | 75           | 75           | 75           | 75           |                   |             |             |
| Costs in foreign exchange   | 500           | 0            | 0            | 0            | 0            | 0            |                   |             |             |
| Other costs   | 150           | 0            | 0            | 0            | 0            | 0            |                   |             |             |
| Total costs   | 912.5         | 75           | 75           | 75           | 75           | 75           | 1088              |             |             |
| Revenues in foreign exchange  | 0             | 400          | 400          | 400          | 400          | 400          |                   |             |             |
| Other revenues  | 0             | 0            | 0            | 0            | 0            | 0            |                   |             |             |
| Total revenues  | 0             | 400          | 400          | 400          | 400          | 400          | 1378              |             |             |
| <b>Total revenues - Total cost</b>  | <b>-912.5</b> | <b>325</b>   | <b>325</b>   | <b>325</b>   | <b>325</b>   | <b>325</b>   | <b>290</b>        | <b>1.27</b> | <b>22.9</b> |
| Telecommunications system   |               |              |              |              |              |              |                   |             |             |
| Wages   | 75            | 37.5         | 37.5         | 37.5         | 37.5         | 37.5         |                   |             |             |
| Costs in foreign exchange   | 800           | 0            | 0            | 0            | 0            | 0            |                   |             |             |
| Other costs   | 100           | 0            | 0            | 0            | 0            | 0            |                   |             |             |
| Total costs   | 975           | 37.5         | 37.5         | 37.5         | 37.5         | 37.5         | 1016              |             |             |
| Revenues in foreign exchange  | 0             | 0            | 0            | 0            | 0            | 0            |                   |             |             |
| Other revenues  | 0             | 350          | 350          | 350          | 350          | 350          |                   |             |             |
| Total revenues  | 0             | 350          | 350          | 350          | 350          | 350          | 1206              |             |             |
| <b>Total revenues - Total cost</b>  | <b>-975</b>   | <b>312.5</b> | <b>312.5</b> | <b>312.5</b> | <b>312.5</b> | <b>312.5</b> | <b>191</b>        | <b>1.19</b> | <b>18.1</b> |
| <b>Project appraisal at social prices: Shadow exchange rate is 20% above official rate, so net foreign exchange flow is raised by 20%</b> |               |              |              |              |              |              |                   |             |             |
| Textile mill  |               |              |              |              |              |              |                   |             |             |
| Wages   | 350           | 100          | 100          | 100          | 100          | 100          |                   |             |             |
| Costs in foreign exchange   | 600           | 0            | 0            | 0            | 0            | 0            |                   |             |             |
| Other costs   | 150           | 0            | 0            | 0            | 0            | 0            |                   |             |             |
| Total costs   | 1100          | 100          | 100          | 100          | 100          | 100          | 1345              |             |             |
| Revenues in foreign exchange  | 0             | 480          | 480          | 480          | 480          | 480          |                   |             |             |
| Other revenues  | 0             | 0            | 0            | 0            | 0            | 0            |                   |             |             |
| Total revenues  | 0             | 480          | 480          | 480          | 480          | 480          | 1654              |             |             |
| <b>Total revenues - Total cost</b>  | <b>-1100</b>  | <b>380</b>   | <b>380</b>   | <b>380</b>   | <b>380</b>   | <b>380</b>   | <b>310</b>        | <b>1.23</b> | <b>21.5</b> |
| Telecommunications system   |               |              |              |              |              |              |                   |             |             |
| Wages   | 100           | 50           | 50           | 50           | 50           | 50           |                   |             |             |
| Costs in foreign exchange   | 960           | 0            | 0            | 0            | 0            | 0            |                   |             |             |
| Other costs   | 100           | 0            | 0            | 0            | 0            | 0            |                   |             |             |
| Total costs   | 1160          | 50           | 50           | 50           | 50           | 50           | 1227              |             |             |
| Revenues in foreign exchange  | 0             | 0            | 0            | 0            | 0            | 0            |                   |             |             |
| Other revenues  | 0             | 350          | 350          | 350          | 350          | 350          |                   |             |             |
| Total revenues  | 0             | 350          | 350          | 350          | 350          | 350          | 1206              |             |             |
| <b>Total revenues - Total cost</b>  | <b>-1160</b>  | <b>300</b>   | <b>300</b>   | <b>300</b>   | <b>300</b>   | <b>300</b>   | <b>-21</b>        | <b>0.98</b> | <b>9.2</b>  |