Session 3.2
Estimation of Project Costs

Introductory Course on Economic Analysis of Investment Projects

1 July 2009
Financial versus economic analysis

• Different definitions of benefits and costs so FIRR not same as EIRR

• Definitions
  • Financial price (FP) = price actually paid
  • Economic price (EP) = estimated economic value
  • Economic value based on ‘opportunity cost’
Definitions

• Externalities = (EP − FP) ie real effect does not show up in financial analysis
• Transfer payments = items with no opportunity cost
• CF = EP/FP
• SCF = average of all CFs
Basic Steps in Economic Viability Analysis

• Identify economic costs and benefits
  – Without vs. with project (incremental)
• Quantify economic costs and benefits as much as possible
• Value the costs and benefits
  – Large vs. small projects
• Compare the costs with benefits
Identifying and Quantifying Costs - 1

• Underlying principle: project cost = the cost difference with and without project, i.e., extra resources needed to produce project benefits

• System costs – if project is part of larger system, include all other system investments needed to achieve project benefits; e.g.,
  – Power generation project may or may not need investment in transmission and distribution
  – A highway section may or may not need investment in preceding or following sections
Identifying and Quantifying Costs - 2

- Sunk costs – those that would exist without or with the project; should not be included
- Contingencies – determined by engineering and financial considerations
  - Physical: monetary value of additional resources that may be required beyond base costs
  - Price: included in financial analysis, excluded in economic analysis.

i.e., economic cost is based on base cost + physical contingencies
Identifying and Quantifying Costs - 3

- Working capital
  - In financial analysis, includes net current assets (inventories, securities, cash, etc.)
  - In economic analysis, include only inventories
  - Changes in working capital are what matter

- Transfer payments
  - E.g., taxes, duties, subsidies
  - Included as cost in financial analysis, but not in economic analysis
Identifying and Quantifying Costs - 2

- **Depreciation and amortization**
  - Accounting convention allows entry as expenses, for computing tax liabilities
  - In financial and economic analysis, such costs amount to double-counting if already counted at time of disbursement

- **External costs**
  - Some costs may not be charged against the project, e.g., air or water pollution
  - Such costs may be internalized, e.g., when pollution charges are imposed, or anti-pollution devices are installed
Valuing Costs

• For financial analysis
  - what project actually pays for the inputs

• For economic analysis –
  - If incremental (coming from augmented supply):
    supply price or opportunity cost
  - If non-incremental (displacing other users):
    willingness to pay
  - If mixture: weighted average of supply and demand prices (opportunity cost and WTP)
Inflation

- Use of constant base year prices
- Relative price shifts (oil, wages)
- Formula: \( RPi = \frac{(1 + Pi)}{(1 + Inf)} - 1 \)
- Where \( Pi \) is inflation for i and \( Inf \) is general inflation eg = \( \frac{(1 + 0.1)}{(1 + 0.06)} - 1 = 1.0377 - 1 = 0.0377 \)
- Relative inflation of 3.77% approx 4%
Does inflation matter?

- Necessary to adjust for relative price changes
- Affects real value items fixed in money terms (e.g., debt repayments, depreciation allowances)
- Nominal devaluation does not matter except for foreign currency debt
- Future real devaluation already incorporated in SERF
## Summary: Economic Pricing of Inputs

<table>
<thead>
<tr>
<th>Category</th>
<th>Project Effect</th>
<th>Basis of Economic Price</th>
<th>Basis of Valuation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tradable</td>
<td>Incremental</td>
<td>supply price</td>
<td>world price CIF</td>
</tr>
<tr>
<td></td>
<td>Nonincremental</td>
<td>demand price</td>
<td>world price FOB</td>
</tr>
<tr>
<td>Nontradable</td>
<td>Incremental</td>
<td>supply price</td>
<td>domestic price excl. tax</td>
</tr>
<tr>
<td></td>
<td>Nonincremental</td>
<td>demand price</td>
<td>domestic price incl. tax</td>
</tr>
</tbody>
</table>
Project Cost Estimate:
Feasibility/ Detailed Design

- Identify project.
- Identify individual project components.
- Classify individual project components.
- Schedule construction and operation and maintenance of individual components within the project design.
- Engage project cost estimator to begin estimating costs in financial terms.
- Engage financial analyst to provide cost estimator with the level of detail required for financial analysis.
- Engage economist to provide cost estimator with the level of detail required for economic analysis.
Project Cost Estimates

- Choice of currency
  - domestic currency (e.g., Som, Tenge, Tugrik)
  - foreign currency (e.g., US$)

- Categories of costs
  - domestic currency costs (e.g., unskilled labor)
  - foreign currency costs (e.g., imported equipment)
  - tradables
  - nontradables
Project Cost Estimates: Types of Costs

a) Investment Costs
- civil works
- electrical works
- mechanical works
- engineering and other professional services
- start-up costs
- vehicles and equipment
- labor
- others
- taxes and duties

b) Recurrent Costs
- salaries
- operation and maintenance costs
  - salaries
  - fuel
  - consumables
  - others

  c) Salvage values

  d) Financial charges
  - interest during construction
Base Cost

**Base Costs** -- best estimates of project costs at a specified date, assuming:

- Quantities of works, goods and services and relevant prices are accurately known.
- Quantities and prices will not change during implementation.
- The project will be implemented exactly as planned.
Contingency Allowances

- Allowance for adverse conditions which will be in addition to the base cost estimate.
- Physical contingencies – to cover physical uncertainties beyond the base case to complete the project. Often calculated and expressed as percentages of base costs.
- Price contingencies – to cover inflation and price uncertainties.

Some typical levels of Physical Contingencies:

- 5% - standard equipment designs/definable civil works, e.g., road surfacing, canal lining.
- 10% - general civil works with routine and predictable uncertainties e.g., roads, buildings, pipelines, transmission lines.
- 15% - plant and civil works in difficult terrain.
Cost Scheduling

- Various methodologies
- Project engineers/designers advise cost estimator on the distribution of costs over the project life.
- For example, major civil works on a hydroelectric project costing $200 million may be disbursed over a 4-5 year period, as follows:

<table>
<thead>
<tr>
<th>Year</th>
<th>%</th>
<th>$ million</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td>2</td>
<td>25</td>
<td>50</td>
</tr>
<tr>
<td>3</td>
<td>40</td>
<td>80</td>
</tr>
<tr>
<td>4</td>
<td>20</td>
<td>40</td>
</tr>
</tbody>
</table>

**TOTAL:** 200
Cost Scheduling

- Built-up for each project component in the base cost.
- Identify foreign and local currency costs separately.
- Physical contingencies allotted.
- Price contingencies allotted.
- Taxes, duties, and other transfer payments quantified.
- Interest during construction calculated.
- Project cost estimate aggregated to derive total cost estimate (i.e., base costs + taxes/duties + contingencies)
- Consolidated annual cost estimate prepared (e.g., capital and O & M costs).
<table>
<thead>
<tr>
<th>Item</th>
<th>Cost Estimates</th>
<th>Financing Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FX</td>
<td>LC</td>
</tr>
<tr>
<td>A. Base Cost&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Civil Works</td>
<td>604.54</td>
<td>1,410.60</td>
</tr>
<tr>
<td>2. Railway Track Work&lt;sup&gt;b&lt;/sup&gt;</td>
<td>120.79</td>
<td>134.47</td>
</tr>
<tr>
<td>3. Buildings and Facilities</td>
<td>3.78</td>
<td>66.16</td>
</tr>
<tr>
<td>4. Signaling and Communications</td>
<td>190.84</td>
<td>138.71</td>
</tr>
<tr>
<td>5. Electric Power and Traction</td>
<td>76.47</td>
<td>106.32</td>
</tr>
<tr>
<td>7. E-Governance and MIS</td>
<td>41.89</td>
<td>37.09</td>
</tr>
<tr>
<td>8. Land Acquisition and Resettlement</td>
<td>0.00</td>
<td>181.43</td>
</tr>
<tr>
<td>9. Other Equipment and Facilities</td>
<td>16.23</td>
<td>14.38</td>
</tr>
<tr>
<td>10. Administration, Consulting Services, and Miscellaneous</td>
<td>32.28</td>
<td>178.41</td>
</tr>
<tr>
<td>11. Environmental Protection Mitigation and Monitoring</td>
<td>0.00</td>
<td>31.97</td>
</tr>
<tr>
<td>12. Temporary Facilities and Transitional Works</td>
<td>0.00</td>
<td>56.11</td>
</tr>
<tr>
<td><strong>Subtotal (A)</strong></td>
<td>1,112.81</td>
<td>2,378.94</td>
</tr>
<tr>
<td>B. Contingencies</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Physical Contingency&lt;sup&gt;c&lt;/sup&gt;</td>
<td>144.30</td>
<td>96.20</td>
</tr>
<tr>
<td>2. Price Contingency&lt;sup&gt;d&lt;/sup&gt;</td>
<td>58.50</td>
<td>87.75</td>
</tr>
<tr>
<td><strong>Subtotal (B)</strong></td>
<td>202.80</td>
<td>183.95</td>
</tr>
<tr>
<td>C. Interest&lt;sup&gt;e&lt;/sup&gt;</td>
<td>49.00</td>
<td>204.43</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1,364.61</td>
<td>2,767.32</td>
</tr>
</tbody>
</table>


<sup>a</sup> At 2005 prices. Import taxes and duties are waived
<sup>b</sup> Including rails, sleepers, ballast, bridge beams, track laying and bridge construction
<sup>c</sup> At 8% of civil works cost, including land acquisition
<sup>d</sup> At 3% per annum of local currency costs and 2% per annum for foreign exchange cost during 2006-2011
<sup>e</sup> This is based on the prevailing US$ 5-year swap rate plus a spread for the ADB loan and the prevailing interest rate for the China Development Bank
Economic Cost Estimate

- Economist advises cost estimator on the breakdown of costs required for the economic analysis.
- Level of detail contingent upon availability of conversion factors and choice of numeraire.
- Include base cost.
- Include physical contingencies.
- Exclude price contingencies.
- Exclude relevant taxes, duties, subsidies, and other transfer payments.
- Classify project components as tradable or nontradable.
Economic decomposition

- Traded goods
- Non-traded goods
- Skilled labour
- Unskilled labour
- Transfers
- Different CFs applied to each
Thank you!