Session 5.1
Distribution Analysis

Introductory Course on Economic Analysis of Investment Projects
9 May 2008
Why Distribution of Project Effects?

Equity Considerations
• Who benefits from the project, by how much?
• Is distribution of effects consistent with project objectives?
• How do benefits reach target groups?

Incentive Considerations
• Who receives, by how much?
• Who pays, by how much?
Examples of Distribution Analysis

• Understand effects of price changes on stakeholder groups, net benefits of service projects

• Assess effects of foreign resources such as BOT projects with foreign sponsors - net capital flows, host country and foreign investor benefits division

• Assess the distribution of economic and financial costs and benefits, and net benefits between poor groups and other stakeholders

➢ Poverty reduction addressed where components effectively reach poor groups
Analytical Focus of Distribution and Poverty Impact Assessment

- Channels of effect: access to employment, markets, resources and assets, services, transfers
- Distribution effects: who receives, who pays
- Time dimensions and directness of effect: short to longer run and direct and indirect effects
- Design implications: mitigation and enhancement measures
Start Distribution Analysis During Sector Work

• Assess without project access to employment, markets, resources and assets, services, transfers

• Assess differences in access by group (such as income) and geographic location

• Identify stakeholder groups that stand to gain or lose by investments

• Assess alternatives that are likely to be effective and sustainable in increasing access, benefit incidence
During Feasibility and Appraisal

• Have the channels of effect been identified to see how costs will be incurred and benefits realized?

• How much are gains/losses from distributing project effects? Do they provide an incentive for response?

• How much is the cost burden to those who will pay? Is the burden acceptable?

• How do targeting/equity considerations affect the overall project performance and returns?

• Can the project and component design be modified and/or complementary measures be taken to enhance impact on target beneficiaries, minimize effect on efficiency?
How Far Can We Take Distribution Analysis?

• Revenue generating projects with quantitative financial/economic analysis
  → quantitative distribution analysis and poverty impact ratio

• Non-revenue generating projects with quantitative benefit analysis
  → quantitative benefit incidence analysis

• Limited quantitative analysis
  → qualitative channel of effect analysis
Stakeholder Groups Analysis

- Owners, operators of project enterprises
- Consumers, users of project outputs
- Goods and service suppliers to the project
- Hired workers, labor for the project
- The government
- Rest of the economy
- Lenders to the project
Distribution Tree:
Example From Road Project

Cost Savings

Passenger Vehicles
- Transport Users
  - Private
  - Government
- Owners
  - Private
  - Government

Freight Vehicles
- Transport Users
  - Private
  - Government
- Owners
  - Private
  - Government
Poverty Impact Tree: Example From Road Project

Private Sector Benefits

Non-Poor

Poor

Government Benefits

Transfers to Non-Poor

Transfers to Poor
1. Estimate the economic costs and benefits relative to financial costs and benefits, i.e., EPV-FPV

2. Distribution Analysis: Distribute differences between financial and economic costs and benefits between project stakeholders

3. Poverty Impact Ratio: Estimate the proportion of the net economic benefits designed to go to the poor compared to total project net economic benefits
Example: Water Supply Project - 1

- Project supplies piped water in a small town
- Three main stakeholders
  - Government/economy
  - Construction labor
  - Water consumers
- Consumers pay for water supplied
- Use domestic price numeraire
- Use discount rate of 12% for FPV and EPV
Methodology:

1. **Identify project stakeholders**, for example, water consumers, labor, government, economy.

2. Calculate present value of financial costs and revenues by component

3. Calculate present value of economic costs and benefits by component

\[
PV(\text{EC}) = PV \text{ financial costs} \pm \text{NPV transfers}
\]

\[
PV(\text{EB}) = PV \text{ consumer surplus} + PV \text{ financial revenues} \pm \text{PV externalities}
\]
Example: Water Supply Project - 3

Methodology cont’d.:
4. Calculate the difference between economic and financial present values

5. Differences between EPV and FPV show project effects

6. Distribute project effects between stakeholders using the identity:
   \[ EPV = FPV + (EPV - FPV) \]

7. Identify net project effects using the identity:
   \[ ENPV = FNPV + (ENPV - FNPV) \]

8. To get distribution of Economic Net Benefits, must adjust for net financial effects incurred by stakeholders
### Example: Water Supply Project - 4

#### 1. Project Financial and Economic Effects

<table>
<thead>
<tr>
<th>Project Costs and Benefits</th>
<th>FNPV</th>
<th>ENPV</th>
<th>ENPV-FNPV</th>
<th>Consumers</th>
<th>Labor</th>
<th>Government/Economy</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output Benefits</td>
<td>1000</td>
<td>1800</td>
<td>800</td>
<td>800</td>
<td></td>
<td></td>
<td>800</td>
</tr>
<tr>
<td>Capital Costs</td>
<td>-650</td>
<td>-600</td>
<td>50</td>
<td></td>
<td></td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Power Costs</td>
<td>-330</td>
<td>-250</td>
<td>80</td>
<td></td>
<td></td>
<td>80</td>
<td>80</td>
</tr>
<tr>
<td>Labor Costs</td>
<td>-80</td>
<td>-56</td>
<td>24</td>
<td></td>
<td>24</td>
<td></td>
<td>24</td>
</tr>
<tr>
<td>Project Effects</td>
<td>-60</td>
<td>894</td>
<td>954</td>
<td>800</td>
<td>24</td>
<td>130</td>
<td>954</td>
</tr>
<tr>
<td>Net Financial Effects</td>
<td>-60</td>
<td>894</td>
<td>954</td>
<td>800</td>
<td>24</td>
<td>-60</td>
<td>-60</td>
</tr>
<tr>
<td>Net Economic Effects</td>
<td>894</td>
<td>800</td>
<td>24</td>
<td>70</td>
<td></td>
<td></td>
<td>894</td>
</tr>
</tbody>
</table>
Poverty Impact Ratio

• An extension of distribution analysis with stakeholders further defined by income or other poverty indicators

• Identify the proportion of poor in stakeholder groups

• Calculate the benefits to poor stakeholders

• Calculate the Poverty Impact Ratio:

$$PIR = \frac{ENPV_{\text{poor}}}{ENPV_{\text{total}}}$$
### Example: Water Supply Project - 5

<table>
<thead>
<tr>
<th></th>
<th>Consumers</th>
<th>Labor</th>
<th>Government/Economy</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Net Economic Effects</strong></td>
<td>800</td>
<td>24</td>
<td>70</td>
<td>894</td>
</tr>
<tr>
<td><strong>Proportion of Poor in Stakeholder Group</strong></td>
<td>0.25</td>
<td>0.33</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td><strong>Benefits to Poor Stakeholders</strong></td>
<td>200</td>
<td>8</td>
<td>35</td>
<td>243</td>
</tr>
<tr>
<td><strong>Poverty Impact Ratio</strong> (Benefits to Poor/Net Economic Effects)</td>
<td></td>
<td></td>
<td></td>
<td>243 / 894 = 0.27</td>
</tr>
</tbody>
</table>
Use Poverty Impact Ratio with Caution

• PIR is a ratio and can reach $\infty$ in limiting case of NPV = 0
  → how much NPV actually goes to the poor (absolute poverty impact)
  → how much NPV goes to the poor per project cost (efficiency of poverty impact)

• Highly sensitive to assumptions on proportion of poor

• If uncertain about proportion of poor, test effect on PIR through sensitivity analysis
ADB Experience

1. Application is confined to energy and transport and communications sectors

2. Identification/categorization of stakeholder groups done routinely; relevant disaggregation that is location-specific could be made to make analyses more insightful to inform project design

3. Analyses not supported by systematic specification of assumptions and parameters

4. Only general statements on the estimated PIR with limited interpretation
Case Study I -
PAK: Sindh Rural Development Project
Project Background

• High Incidence of Rural Poverty in Rural Sindh
• Majority of Rural Poor are Landless and Tenants
• Highly Indebted Tenants
• Selective Compliance with Tenancy Laws
Tenancy Arrangements

• Responsibility of Providing Seed
• Responsibility of Crop Operations (Manual and Mechanized)
• Responsibility of Irrigation Water
Root Cause of Rising Poverty Amongst Tenants

- Unfavorable Tenure Terms
- Lack of Transparent Accounting
- High Cost of Financing
  - Debt Bondage to Landowners
  - Lack of Bargaining Power
  - Increasing Poverty
Project Interventions

• Legal Reforms
• Community Organization
• Productivity Enhancement
• Improvements to Infrastructure to Support Legal Reforms and Productivity Enhancement Efforts
Potential Gains

- Improved Crop and Livestock Productivity
- Improved Cost Sharing Arrangements
- Security of Tenure and Improved Bargaining Power for Tenants
- Higher Farm Incomes for Tenants and Landowners
Approach to Analysis

- Identification of Stakeholders
- Distribution of Project Implementation and Production Costs
- Distribution of Gains to Stakeholders
- Scenario I – Impact without Legal Reforms
- Scenario II – Impact With Legal Reforms
Scenario I - Stakeholder Wise Distribution of Gains

- **Added Output**
  - Landowners
  - Tenants

- **Proj. Imp.**
  - Landowners
  - Tenants

- **Prod. - Non Labor**
  - Tenants

- **Prod. - Labor**
  - Tenants

Legend:
- Landowners
- Tenants
- Labor
- Government
Scenario I - Gains Accruing to the Poor

Gains (PRs Million)

Landowners | Tenants | Labor | Government

Below Poverty Line | Above Poverty Line
Scenario II – Distribution of Gains With Legal Reforms

- Added Output
- Proj. Imp.
- Prod. - Non Labor
- Prod. - Labor

- Landowners
- Tenants
- Labor
- Government

Gains (PRs Million)
Scenario II - Gains Accruing to the Poor

<table>
<thead>
<tr>
<th>Category</th>
<th>Gains (PRs Million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landowners</td>
<td>-20</td>
</tr>
<tr>
<td>Tenants</td>
<td>40</td>
</tr>
<tr>
<td>Labor</td>
<td>10</td>
</tr>
<tr>
<td>Government</td>
<td>30</td>
</tr>
</tbody>
</table>

- **Below Poverty Line**
- **Above Poverty Line**
Approach to Analysis

• In the absence of Legal Reforms, PIR = 53%
• With Implementation of Legal Reforms, PIR = 77%
• Absence of Legal Reforms Reduces PIR by almost one third
Case Study II - INO: Participatory Irrigation Sector Project
Project Background

• While irrigation sector claims a significant part of public resources, infrastructure is inadequate, inappropriate and is decaying

• Support for Implementing Irrigation Management Policy Reforms of 1999
Project Interventions

- Develop & Strengthen Institutions at District and at Water Users’ Level
- Support to Transfer of Irrigation Management
- Support to Rehabilitate and Upgrade Schemes, Sustainable Replacement of Rehabilitation and Improved O&M
- Water Resources Information System
Potential Benefits of Improved Management

- Improved Irrigation System Management
- Reduced Inequity in Water Distribution
- Improved Crop Productivity
Approach to Analysis

- Identification of Stakeholders
- Distribution of Project Implementation and Production Costs
- Distribution of Gains to Stakeholders
Stakeholder Wise Distribution of Gains

- **Proj. Output**
  - Farmers
  - Labor
  - Government/Economy

- **Proj Imp. - Non Labor**
  - Farmers
  - Labor
  - Government/Economy

- **Proj Imp. - Labor**
  - Farmers
  - Labor
  - Government/Economy

- **O&M - Non Labor**
  - Farmers
  - Labor
  - Government/Economy

- **O&M - Labor**
  - Farmers
  - Labor
  - Government/Economy
Poverty Incidence on Irrigation Schemes

Poverty Incidence (%)

- Upper Reach Farms
- Middle Reach Farms
- Tail Reach Farms
- Labor
- Agricultural Sector
- National
Expanded Approach to Analysis

- Identification of Stakeholders with Reach Wise Distinction Between Farms
- Distribution of Project Implementation and Production Costs
- Distribution of Gains to Stakeholders
Stakeholder Wise Distribution of Gains

Gains (Rp Million)

- Proj Output
- Proj Cost - Non Labor
- Proj Cost - Labor
- O&M Cost - Non Labor
- O&M Cost - Labor

Legend:
- Upper Reach Farms
- Middle Reach Farms
- Tail Reach Farms
- Labor
- Government/Economy
Gains Accruing to the Poor

Gains (Rp Million)

- Upper Reach Farms
- Middle Reach Farms
- Tail Reach Farms
- Labor
- Rest of Economy
- Overall

Benefits to Poor • Benefits to Non Poor
Thank you.