Session 9
Assessing Welfare Impact of PBL Operations: Concept & Method

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Introductory Course on Economic Analysis of Policy-Based Lending Operations
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Main Objectives

Introduction to:

• Quantitative Assessment Methods
• Different Methods and Applications

Non Objectives:

• Details of model specification and estimation
• Complete results of past analyses
• Road map for carrying out such analyses
Role of Quantitative Analysis (1)

- Economic analysis for policy operations: what is involved, can it be done?
- A proposed policy change is based on an opinion that the reform will improve the condition.
- Issue is not if economic analysis can be done but how it can be done.
Role of Quantitative Analysis (2)

- Fill the gap between Theory and Reality
  
  *Policy cannot be determined based on textbooks!*

- Add to quantitative dimensions, leading to measurement: *What can’t be measured can’t be managed*

- Enable for Sensitivity/Scenario Analysis
  
  *Informs policy dialogue and provides options*
Conceptual Framework

Microeconomic analysis of:

- Consumers, Producers, Households, Single market, Sectoral Policy, Macroeconomic Policies and the links among them.
- Each of them has standard behavior reflected in the modeling analysis.
The Need for Assessments

Figure 2.2 Simplified Model of Project Monitoring and Evaluation Framework Process

- **Inputs**: Financial, human, and material resources
- **Activities**: Actions undertaken to implement the project
- **Outputs**: Goods and services produced by the project
- **Outcomes**: Specific welfare effects of project on target group
- **Impact**: Ultimate objective of the project

**Issues:**
- Identification and Measurement

Example of Assessment Framework

Figure 2.3 Framework for the Analysis of the Impacts of Education on Women

Note: The framework can be modified for other sectors/programs!
Basic Idea of Assessments

- **Model:**
  \[ Y = f(X, P) \]

  \( Y = \) outcomes, endogenous variables concerned
  \( X = \) Uncontrollable Exogenous variables
  \( P = \) Policy Instruments
  \( Y_o, X_o, P_o = \) Base run, base line, benchmark
  \( Y_r - Y_o = \) Impacts, which should be analysed based on a set of criteria (i.e. welfare, poverty reduction, inequality, feasibility, etc)

- **Note:** \( f \) is the functional approach
# Alternative Techniques

<table>
<thead>
<tr>
<th>Feedback Effects</th>
<th>Data Availability and Analytical Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>• Low</td>
</tr>
<tr>
<td></td>
<td>• Descriptive statistical analysis</td>
</tr>
<tr>
<td></td>
<td>• Qualitative impact assessments with specified assumptions</td>
</tr>
<tr>
<td></td>
<td>• Reduced use of tools in adjacent cells in conjunction with specified assumptions</td>
</tr>
</tbody>
</table>

| Medium           | • Medium                                  |
|                  | • Partial equilibrium analyses of prices, supply and demand parameters |
|                  | • Budget analysis                         |
|                  | • Benefit incidence analysis              |
|                  | • Affordability and willingness-to-pay analysis |

| High             | • High                                    |
|                  | • Survey-based household models           |
|                  | • Full econometric demand and supply analysis |
|                  | • Fiscal impact and public expenditure analysis |
|                  | • Comparative institutional, transaction cost analysis |

| High             | • High                                    |
|                  | • Qualitative impact assessments of inter-temporal and distributional effects |
|                  | • Descriptive statistical analysis        |

| Medium           | • Medium                                  |
|                  | • Reduced form input/output analysis and simulation models |

| High             | • High                                    |
|                  | • Social accounting matrices—input/output analysis |
|                  | • Multimarket analysis                    |
|                  | • Computable general equilibrium          |
Alternative Assessments

1. *Ex Ante and Ex Post*:
   - Before and After
   - Benchmark Monitoring

2. *With and Without*:
   - Scenarios of With and Without cases
   - Comparison with benchmark

3. *Combination*:
   - Maximising the benefits
   - Strengthen the case
Impact Assessments

1. Of What
2. On What
3. On Whom
4. How, including effect channel
5. When
6. If and the risk
Good Impact Assessments: Aspects

1. The right question
2. Stakeholders
3. Transmission channel
4. Institutional context
5. Data and information
6. Measurements
7. Impact analysis
8. Risk assessment
9. Monitoring and Evaluation
Types of Models

Model/methods:
1. Statistics
2. Econometrics
3. Others (e.g. General Equilibrium)

Coverage:
1. Partial
2. General

Aspects:
1. Static
2. Dynamic
**Statistical Modelling**

1. **Descriptive Statistics:**
   - Based on sample statistics
   - Description of samples based on Summary of Statistics

2. **Inference Statistics:**
   - Based on sample statistics
   - Estimation and Hypothesis testing, parameter estimate, and general trend
3. Non parametric statistics
   • No population distribution assumed

4. Other Statistical Modeling
   • Index and Classification system, etc
Correlation Analysis

- To measure strength of association (linear relationship) between two numerical variables (output of project with another variable concerned)
  - Only concerned with strength of the relationship
  - No causal effect is implied
- Feature
  - Unit free
  - Range between -1 and 1
  - The closer to -1, the stronger the negative linear relationship
  - The closer to 1, the stronger the positive linear relationship
  - The closer to 0, the weaker the linear relationship
Econometrics: Regression Analysis

• Mainly to model causality (relationship) and provide prediction.

• Types of Model
  • Data: Cross section (Dependent (Yi) and Independent (Xi) variables); Time Series (One variable only); and, Panel Data (Dependent and Independent variables across regions or sectors).
  • Variables: Discrete, continues, categorical/qualitative.
  • Equation: Single and simultaneous equations with many functional forms.
  • Other issues: Estimation methods and variable measurements.
Types of Regression

- **Positive Linear**
- **Negative Linear**
- **NOT Linear**
- **No Relationship**
Dummy Variables

- Categorical explanatory variable (dummy/dichotomous variable).
- For Yes or No, On or Off, Male or Female, With or Without, Before or After, etc.
- Coded as 0 or 1 (1 for the case and 0 for otherwise).
- Can be used in Additive and/or Multiplicative/Interactive specification.
Additive and Interactive Dummies

\[ \hat{Y}_i = b_0 + b_1 X_i \]

Intercepts different

\[ \hat{Y}_i = a_0 + a_1 X_i \]

Desirable

Undesirable

Change in slopes

Same slopes
Pitfalls of Regression Analysis

• Ignoring the underlying assumptions.
• Not knowing how to evaluate the assumptions.
• Not knowing the alternatives methods if a particular assumption is violated.
• Using a regression model without knowledge of the subject matter.
Time-Series Analysis: Components

Forecasting or identifying significant changes based on time series model

- Trend
- Cyclical
- Seasonal
- Random
Trend and Cyclical Components

**Trend:**
- Overall upward or downward movement
- Data taken over a period of times (weeks, months, years etc)

**Cyclical:**
- Upward or downward swings
- May vary in length

![Graph showing trend and cyclical components with labels for trend, cyclical, and time.](image)
Pitfalls of Time-Series Analysis

• Time series behavior in the past will still hold in the future.

• No consideration on personal judgments, experiences, changing technologies, and habits, etc.
Other Models: Partial Equilibrium Analysis

- Focus on one aspect of economic activity (demand or supply side), a single sector or good.
- Assumptions: *ceteris paribus* and does not allow for feedback effects.
- Examples:
  - **Demand**: Effect of price/market/environment changes on demand (Increasing tax/reducing subsidy on consumers)
  - **Supply**: Effect of price/market/environment changes on supply (Increasing tax/reducing subsidy on producer)
  - **Supply and demand**: Combination of supply and demand.
  - **Agricultural Household Models**: Impact of policy/price changes on Agricultural Household.
  - **Transactions costs assessments and analysis of interlinked markets**, comparative institutional analyses, relative cost effectiveness etc.
Other Models: Partial Equilibrium Analysis

- Economy-wide Modeling Effects
- Based on a sound theoretical concept (microeconomics)
  - Consumers: Maximizing Utility, subject to budget constraints
  - Firms: Maximizing profit, choosing inputs and technology
  - Governments: ??? (2 alternatives: Planned or residual consumption)
- Examples:
  - Input-Output
  - Social Accounting Matrices (SAM)
  - Computable General Equilibrium (CGE)
Input-Output Modelling

Main Issue

- Backward & Forward Linkages
- Multiplier Effects
- Induced Effects of Specific Intervention

Main Assumption

- Excess Capacity in the Economy
- Constant Technology
- Fixed Price

Use:

- Linkage Analysis across sectors
- Looking for the highest effect
- Project Sector output requirements
- Impacts on labor, income, value added etc.
## Input-Output Modelling Framework

### Table:

<table>
<thead>
<tr>
<th>Intermediate outputs</th>
<th>Intermediate inputs</th>
<th>Final Demand (Y)</th>
<th>Gross output</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>X11</td>
<td>X12</td>
<td>X13</td>
</tr>
<tr>
<td></td>
<td>Y1C</td>
<td>Y1I</td>
<td>Y1G</td>
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<tr>
<td></td>
<td>X1</td>
<td></td>
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<tr>
<td></td>
<td>X21</td>
<td>X22</td>
<td>X23</td>
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<tr>
<td></td>
<td>Y2C</td>
<td>Y2I</td>
<td>Y2G</td>
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<td></td>
<td>X2</td>
<td></td>
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<td></td>
<td>X31</td>
<td>X32</td>
<td>X33</td>
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<td></td>
<td>Y3C</td>
<td>Y3I</td>
<td>Y3G</td>
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<td></td>
<td>X3</td>
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<td>X41</td>
<td>X42</td>
<td>X43</td>
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<tr>
<td></td>
<td>Y4C</td>
<td>Y4I</td>
<td>Y4G</td>
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<td></td>
<td>X4</td>
<td></td>
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<tr>
<td>Value added</td>
<td>L</td>
<td>VL1</td>
<td>VL2</td>
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<td></td>
<td>V1C</td>
<td>V1I</td>
<td>V1G</td>
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<td>L</td>
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<td></td>
<td>N</td>
<td>VN1</td>
<td>VN2</td>
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<td></td>
<td>V2C</td>
<td>V2I</td>
<td>V2G</td>
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<td></td>
<td>N</td>
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<td></td>
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<tr>
<td>Gross input</td>
<td>X1</td>
<td>X2</td>
<td>X3</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>I</td>
<td>G</td>
</tr>
</tbody>
</table>

### Effects:

- **Direct**
- **Direct+Indirect**
- **Direct+Indirect+Induced**
- **Direct+Indirect+Induced+Government Interaction**
SAM-Based Modelling

Developed based on Social Accounting Matrix

What is SAM?
1. Transaction records of an economy in a particular time presented in a square matrix
2. Include Production, Consumption, and Investment
3. Further Development of IO

Types of Model:
1. Fixed Price - SAM Multiplier Analysis
2. Flexible Price - CGE Modeling

Main Characteristics:
1. SAM Multiplier Analysis: Fixed Price, Backward and Forward Linkages with more institutions (not only on production sectors)
2. CGE Modeling: Complete modeling of an economy.
Box 2.7 The Social Accounting Matrix (SAM)

A SAM is basically a system of presenting the economic and social structure of a country (region) at a particular time, by defining the representative actors or economic agents in the underlying economy and recording their transactions. The transaction values are presented in a square matrix (as opposed to the double entry format of standard accounting report of T-typed account, i.e. the one used in the accounting report) with its rows representing detailed receipts by each particular account and its columns recording the corresponding expenditures. It then follows that every income has its corresponding expenditure, and the incoming and outgoing of any account must always balance. The SAM is essentially constructed to correspond to the underlying economy and therefore the model’s main features. Entries in a SAM can be categorized into two groups, one that reflects flows across markets to represent transactions in the product and factor markets, and another one that reflects transfer payments from one agent to another.

There is, however, no 'standard SAM' so that the disaggregation level and choice of representative actors depend entirely on the motivation underlying the SAM's development and the availability of data. For PIA, the classifications of factors (especially worker) and household should be relatively detailed to enable the model to capture the changes in the factor income allocation and, therefore, welfare status of different household and worker groups.

In a statistical system, a SAM provides complementary economic indicators, which concern not only the macroeconomic aggregates of the System of National Accounts (the SNA) but also on the socio-economic structure and distributional aspects of the economy. Accordingly, SAM can be thought of as a further development of input-output accounts, which concentrate only on the production side of the economy. It must be noted, however, that every SAM is only a static image or 'snapshot' of an economy. Nevertheless, it can provide the statistical basis for the development of plausible models when more than a static image is needed (King, 1985). Table 2.4 provides a schematic representation of SAM for Indonesia as an example. As can be seen, the matrix records a comprehensive transaction conducted by economic actors in the economy for a period of time that includes economic and transfer payments.

Constructing SAM can be very time consuming and burdensome, involving reconciliations of various data from the input-output tables, national income accounts, foreign trade, and other sources. If the basic data are not readily available, however, some specific surveys must be conducted first before constructing a SAM.

Source: Author's summary
### Table 2.4 Schematic Representation of Indonesian SAM

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</tr>
</thead>
<tbody>
<tr>
<td>1. Factors</td>
<td></td>
<td>Value Added</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>a). Labour</td>
<td></td>
<td>Wages</td>
<td></td>
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<td></td>
<td></td>
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<td></td>
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<tr>
<td>b). Capital</td>
<td></td>
<td>Profits/Rents</td>
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<tr>
<td>2. Institution</td>
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<td></td>
</tr>
<tr>
<td>a). Households</td>
<td>Factor Income</td>
<td>Transfers</td>
<td></td>
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<td></td>
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<tr>
<td>b). Firm</td>
<td>Factor Income</td>
<td>Transfers</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>c). Government</td>
<td>Factor Income</td>
<td>Direct Taxes</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>3. Activities</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Production Allocation</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>4. TTM</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Mark-up for TTM</td>
<td>Mark-up for TTM</td>
<td></td>
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<tr>
<td>5. Domestic Comm.</td>
<td>Final Consumption</td>
<td>Intermediate Consumption</td>
<td>Transfers/Consumption</td>
<td>Investment</td>
<td>Exports</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Imported Comm.</td>
<td>Final Consumption</td>
<td>Intermediate Consumption</td>
<td></td>
<td>Investment</td>
<td></td>
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<td></td>
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<tr>
<td>7. Capital</td>
<td></td>
<td>Savings</td>
<td></td>
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<tr>
<td>8. Net Indirect Tax</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ind. Tax Payment</td>
<td>Ind. Tax Payment</td>
<td></td>
<td></td>
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<tr>
<td>9. ROW</td>
<td>Remittance</td>
<td>Transfers</td>
<td></td>
<td></td>
<td>Imports</td>
<td>Capital Outflows</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Sugiyarto et al. (2003).
### SAM Multiplier Analysis

<table>
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</tr>
</thead>
<tbody>
<tr>
<td>1. Factors</td>
<td></td>
<td></td>
<td>T_{13}</td>
<td></td>
<td>X_1</td>
<td>Y_1</td>
</tr>
<tr>
<td>2. Institutions</td>
<td>T_{21}</td>
<td>T_{22}</td>
<td></td>
<td></td>
<td>X_2</td>
<td>Y_2</td>
</tr>
<tr>
<td>3. Productive activities</td>
<td></td>
<td></td>
<td>T_{32}</td>
<td>T_{33}</td>
<td>X_3</td>
<td>Y_3</td>
</tr>
<tr>
<td>4. Exogenous accounts</td>
<td>L_1</td>
<td>L_2</td>
<td>L_3</td>
<td>LX</td>
<td></td>
<td>Y_4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>Y_1</td>
<td>Y_2</td>
<td>Y_3</td>
<td>Y_4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
CGE Model: Schematic Representation

Figure 2.4 The Inter-linkage Nature of Economy Represented by CGE Model

Source: ADB PRISM.
CGE Model: Production Structure

Based on microeconomics, maximization process, flexible price, no excess capital, relatively flexible functional specifications and widely used for different applications.
CGE Model: Consumption Structure
# Summary

## Assessing the Effects of Policy Change

### Table 7: Approaches to Assessment of Policy Operations

<table>
<thead>
<tr>
<th>Approach</th>
<th>Advantages</th>
<th>Disadvantages</th>
<th>Possible Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>Descriptive statistical analysis and ad hoc calculations</td>
<td>• Simple to apply Minor data and time requirement</td>
<td>• Requires specific parameters such as demand and supply elasticities</td>
<td>• Power restructuring e.g., Loan 1662-PHI</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Captures only one dimension</td>
<td>• Health reform e.g., Loan 1568-MON</td>
</tr>
<tr>
<td>Partial equilibrium modeling: Market and price analysis</td>
<td>• Fewer data required than computable general equilibrium modeling</td>
<td>• Cannot capture computable general equilibrium modeling feedback effects</td>
<td>• Education e.g., Uzbekistan Education Sector Development Program</td>
</tr>
<tr>
<td></td>
<td>• More workable and easier to interpret results qualitatively</td>
<td>• Not useful for complex reforms</td>
<td></td>
</tr>
<tr>
<td>Partial equilibrium modeling: Comparative institutional analysis</td>
<td>• Considers the costs of institutional transactions that can be key to understanding incentives and efficiency improvements</td>
<td>• Limited in ex-ante analysis because of the difficulty in estimating transaction costs</td>
<td>• Self-contained price changes such as agriculture subsidy e.g., Loan 1739-PHI</td>
</tr>
<tr>
<td>Applied computable general equilibrium</td>
<td>• Can simulate counterfactuals</td>
<td>• Considerable data and time requirements</td>
<td>• Transaction cost approach is relevant in analyzing the rural economy where small farmers and traders facing high transaction costs resulting in thin markets, market failure in the provision of credit, inputs, and services, and incomplete or imperfect land and labor markets e.g., Loan 1739-PHI</td>
</tr>
<tr>
<td></td>
<td>• Useful for impact of price changes like devaluation and interest rate rises</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: EREA staff.
Tools for PIA Developed by ERD

Figure 1.2 Tools for PIA developed by ERD

- Poverty Predictor Modeling (PPM)
- Poverty Mapping Modeling (PMM) and GIS Application (PRISMA)
- Computable General Equilibrium Modeling (CGE)
- CGE-Micro-Simulation (CGE-MS)
- Poverty Reduction Integrated Simulation Modeling (PRISM)
- Other Independent Research

Poverty Impact Analysis (PIA)
Main issue?

- Main issue concerned
- Scope of attribute or impacts
- Best tools available- one model does not fit all!
  - Microeconomic foundations
  - Linking empirical data to policy outcomes
  - Partial versus general equilibrium
- Trade-offs between modeling approaches
- Modeling Application in operations, including the best time for incorporation

Best Approach?

Constraints: Data, Methods, Capacity, Time, etc!

Appreciating models and their use!!
Thank You