



Simple Macroeconomic Model for MDGs based Planning and Policy Analysis

Thangavel Palanivel
UNDP Regional Centre in Colombo

Outline of the presentation

- **MDG consistent Simple Macroeconomic framework (SMF)**
- **Need for a macroeconomic model for MDG based planning**
- **Commonly used modelling approaches**
- **Best strategy in model building**
- **SMF process and steps**
- **Tentative training schedules for Sri Lanka**

MDG consistent SMF (1)

MDG-consistent SMF is the framework that

- provides a set of sectoral projections consistent with each other and also with macroeconomic goals and policies, and
- takes into account the level and composition of investment required to achieve MDG targets and its potential effect on the economy.

MDG consistent SMF (2)

Examples of MDG consistent macroeconomic framework

- Projections of real sector (i.e., growth, consumption, investment, etc) need to be consistent with projections of fiscal, monetary and external sectors and MDG targets
- Projections of fiscal accounts (revenue, expenditures, fiscal balance) need to be consistent with real, external, and monetary sector projections and MDG financing requirements.

MDG consistent SMF (3)

- **Sectoral projections need to be consistent with national development goals and targets such as growth, poverty, inflation, etc.**
- **Investments based on MDG NA may create some imbalances among macro variables. Developing MDG consistent macroeconomic framework is a process to provide policy options to address it.**

Objectives of MDG consistent SMF

- Provide input for preparing MDG based long term development planning
- Strengthen coherence between planning and MTEF/budgetary framework
- Provide a monitoring & evaluation framework
- Support the national policy dialogue & negotiations with development partners

Macroeconomic Model

- Macroeconomic models are **numerical representations** of economic theory, intuition and data.
- They **highlight the important linkages** and transmission mechanisms in the economy
- They **provide a consistent framework** within which behavioural relationships are stored and policy issues examined.

Need for a Macroeconomic Model for MDG based Plans? (1)

- Socio-economic variables interact in a complex manner; a macroeconomic model helps to **understand the complex interaction**
- It helps in **developing a MDG consistent macroeconomic framework** which is key for formulating MDG based national plans.
- It also helps in **undertaking ex-post and ex-ante policy impact assessment and monitoring** which are key for designing MDGs oriented policies/strategies.

Need for a Macroeconomic Model for MDG based Plans? (2)

- It complements the work on MDG sectoral need assessments towards preparing MDG based plan
- Because it analyze the impact of scaling up expenditure and assesses the 'absorptive capacity' of the economy
- It is also useful in addressing some emerging issues such as the impact of crude oil and food price increases.

Major Approaches in Macroeconomic Modelling

- **Macroeconometric Approach (i.e., ME Models)**
- **Computable General Equilibrium Approach (i.e., CGE Models)**
 - (focuses on modelling approaches, not on specific models)

Macroeconometric Models

- Main purpose is to produce **short-term forecasts or long-term outlook** and policy evaluation.
- Main strength lies in their ability to **estimate robust parameters**
- Main weakness is that the parameters may not properly capture the **changes in the policy regime**.

CGE Modelling

- CGE modelling is aimed to **incorporate micro behaviour** into macroeconomic analysis
- Main purpose is **policy evaluation**.
- But are **complex** and **data-demanding** (detailed input-output matrix for a year)

Key Difference between ME and CGE Approaches

- **ME modelling**: parameter values are estimated using econometric techniques
- **CGE modelling**: parameter values are drawn from a variety of sources
 - Prior econometric studies
 - Other simulation models
 - Intuition and judgment

Choosing Among Approaches

- No single economic model or approach can fully capture all the interactions and impacts
- Different models are designed for different purposes
- A model must ultimately be judged on whether it answers the questions it was designed to answer

No "One Size Fits All" Model

Best Strategy in Model building

- Start small: **Go small to large**
- Start simple: **Go from simple to complex**
- Choose approach (ME or CGE models) depending upon objectives and data availability
- Choose software (EViews, Vensim, Gams) depending upon modelling types
- Keep it transparent - **avoid any 'black-box' syndrome**
- Develop several models instead of try to address all issues by one model
- Have always two versions of the model: one operational and another in development

Roll-out Experience of SMF in Asia and the Pacific

- SMF has already been applied in **Bhutan and Mongolia**.
- In Bhutan, the model has been used for the preparation of 10th Five-Year Plan.
- In Mongolia, the model has been used for formulation of MDG strategies and MTEF
- There are request from a few more countries (e.g., **Laos and Nepal**)
- Key aspects of the SMF roll-out are given below:

SMF Initial considerations- what we wanted

- **A simple projection/policy evaluation model** taking into consideration of the specificities of LDCs
- **Capable of analyzing MDG resource needs and policy options** in an integrated framework
- **Comprehensiveness** - enough disaggregation in the real and fiscal sectors to analyse the macroeconomic impact of scaling-up of public expenditures
- **Long-Term perspective** until 2015
- **User-friendliness** and local expertise
- **Timeliness** - six months to complete initial phase of the work and capacity development

SMF Initial considerations - what we decided

- A Simple Macroeconometric structural Model because that is what commonly used for long-term projection/scenarios analysis
- By using EViews software because that is what commonly used for ME structural models
- **Production** disaggregated into 3 sectors - agriculture, industry and services.
- **Prices/inflation** disaggregated into 3 components.
- **Government Revenue** disaggregated into 5-7 categories
- **Government expenditure** disaggregated into 7-8 sectors - in line NA sectors classification.

SMF Process (1)

In terms of process, it is

- Aimed to build national capacity
- Nationally owned
- Part of on-going planning exercises
- Transparent
- Reviewed and updated periodically

SMF Process (2)

- **SMF is being implemented jointly by national teams (policy makers and researchers) and RCC modelling experts**
- **Trained country teams in analytical methodology and computer software**
- **Adapted to country requirements**
- **Knowledge sharing through international/regional workshops**
- **Continuous technical back stopping by RCC experts**

SMF Steps

- Step 1:** Specifications of the Model
- Step 2:** Data collection and Assessment
- Step 3:** Parameters Estimation
- Step 4:** Solving the model for historical period
- Step 5:** Historical Validation
- Step 6:** Choice of Scenarios (BAU, MAG, etc)
- Step 7:** Link SMF with MDG NA and provide input for MDG based plans
- Step 8:** Link SMF with on-going long/medium term planning process and provide inputs for budgetary and planning process

Step 1: Specifications of the RCC Model (1)

- **Real sectoral GDP** is determined by land, labour & capital, and their productivity.
- **Real private consumption** is determined by real GDP, inflation and interest rate.
- **Real government consumption** is determined by govt revenue, inflation and its own lag
- **Real private fixed investment** is based on real GDP, inflation, interest rate and net domestic credit
- **Public investment** is based on public expenditure and inflation.

Step 1: Specifications of the RCC Model (2)

- **Sectoral GDP deflators (inflation)** are estimated through money supply, import prices and imbalances in the supply & demand.
- **Prices of other items** (consumption, investment, exports and imports) are determined by GDP deflator
- **Money supply** is determined through an identity of domestic credits to private and public sectors, net foreign assets, etc.
- **Net foreign assets** are based on CAB, exchange rate, and its own lag
- **Net domestic credit to the public sector** is determined by fiscal balance and real GDP
- **Net domestic credit to the private sector** is determined by real GDP and interest rate

Step 1: Specifications of the RCC Model (3)

- Sub-components of **tax revenue** are determined by their respective tax rates and tax bases
- Sub-components of **non-tax revenue** are estimated by linking nominal GDP in industry and services
- Sub-components of **government expenditure** are determined on the basis of availability of government revenue, grants, and public borrowing.
- **Fiscal balance** is obtained by subtracting expenditure from revenue

Step 1: Specifications of the RCC Model (4)

- **Disaggregated nominal exports** are function of domestic output, world GDP, relative price (domestic price vs. external price), exchange rate, and capital goods imports.
- **Disaggregated nominal imports** are determined by exchange rate and net forex resource availability after deducting the interest and other payments.
- **CAB** is determined from trade balance, net foreign income (dividends, interest) and current transfers (ODA, remittances, etc).

Step 1: Specifications of the RCC Model (5)

- Labour supply is determined through population growth and labour force participation rate.
- Labour demand is estimated through sectoral GDP growth, wages and technology
- Labour productivity is determined through public expenditure on education and health in order link MDG investment with real sector.
- Disaggregated social (including MDGs) sector model depends upon the data availability.

Overview of the Bhutan Model

Blocks	Behavioural equations	Identities/ Linking equations	Total Number of Equations
Real sector	7	28	35
Price Block	8	1	9
Fiscal Sector	15	18	33
Monetary Sector	4	3	7
External Sector	6	10	16
Social sector including labour markets/ MDGs	7	4	11
Total Number of Equations	47	64	111

Step 2: Data Requirements and Assessment (1)

- **GDP and its components:** sectoral value added, personal consumption, government consumptions, private investment, and public investment
- **Prices:** deflator for GDP components
- **Revenue:** taxation, non-taxation, and grants
- **Expenditure:** Expenditure by sectors
- **External trade:** exports, imports, exchange rate,
- **Monetary:** money supply, net foreign exchange asset, net domestic credit to private and public sectors, interest rate,
- **Social sector:** Poverty, Gini ratios, HDI, literacy rate, life expectancy rate, population, labour and employment

Step 2: Data Collection and Consistent checking (2)

- Required data collected or compiled from variety of sources
- Preferences given to government publications
- Wherever data not available from government sources readily, then the required data are obtained from ADB and World Bank database
- Data are checked for consistency as well as for stationary

Step 3: Parameters Estimation

- All equations were estimated in a linear form by using OLS method
- Non-stationary variables have been estimated by using first differences or Error Correction Method (ECM).
- Diagnostic testing has been done by using standard methods such as ' R^2 ' for goodness of fit, ' t ' statistics for significance of coefficients, ' $D.W$ ' test for serial correlation, ' $RMSPE$ ' for model reliability, etc.
- Dummy variables have been used frequently to take care of data outliers

Step 4: Solution of the model

- The model specified in the step 1 updated with estimated parameters
- Model was then solved for 1996-2005 to assess the performance

Step 5: Historical Validation

- Comparison of actual and estimated values for the period 1996-2005
- Error (RMSPE) values are less than 10 % for most of the variables
- Errors are relatively small for key indicators such as GDP, inflation, total revenue, total expenditure, exports, imports, etc.
- Errors are relatively large for non-tax revenue, credit to public sector, expenditure on public works, fiscal deficits, trade balance, and savings.

Step 6: Choice of Scenarios

- 'Business-as-usual' simulation can be used as Base line for comparison
- MDG NA simulation - to examine the possible impact of scaling up public expenditure on the economy.
- Other policy simulations - e.g., tax reforms simulation to assess the potential scope of rising domestic resources to meet the MDGs

Step 7: Linking SMF with MDG NA estimates

- Since our aim is to prepare MDG consistent macro framework, we need link SMF with MDG NA estimates
- This will indicate the macro economic implications of MDG NA related investment
- This will also indicate economic growth rate (and its distribution) required to achieve income poverty targets
- This will also help in developing comprehensive MDG financing strategy

Step 7: Linking SMF with MDG NA estimates

- NA sectoral cost on education, health and agriculture linked with respective SMF sectoral equations of public expenditure
- NA costs on gender and capacity development linked with SMF equation on general administration expenditure
- NA cost on roads, water and sanitation linked with SMF equation on public works expenditure
- NA cost on energy and environment linked with SMF equation on public expenditure for trade, industry and power

Step 8: Linking SMF with Budgetary Framework

- Long term MDG consistent SMF can provide inputs for formulation of medium term fiscal and expenditure framework (MTFF, MTEF) through
 - longer term revenue, expenditure and investment projections
 - Undertaking policy simulations to prioritize public investments

Bhutan SMF Key Findings

Parameters estimation for the period 1980-2005 shows that

- Output responsive to changes in investment is relatively higher in the services sector compared to other sectors
- Inflation seems to be borrowed phenomenon here. It is mainly determined by prices of imports, which in turn determined by Indian prices.
- 1 % increase in the import prices is likely to increase the prices of agricultural, industrial and services items by 0.88, 1.24 and 0.76 % respectively.

Bhutan SMF Key Findings

- Changes in tax bases (nominal GDP) rather than changes in tax rates play a key role in determining changes in tax revenue
- A 1% increase in the nominal GDP is likely to increase the tax revenue by 1.1% (i.e., tax buoyancy rate)
- A 1% increase in GDP is expected to increase household consumption by 0.52%. If GDP increases by 8-9%, then it takes about 13-15 years to double HH consumption levels **or** to reduce poverty incidence by half

Bhutan SMF Key Findings

BAU simulation for the TYFP (2008-12) period shows that

- Real GDP - 8.2%
- Agricultural GDP - 3.7%
- Industrial GDP - 9.8%
- Services GDP - 8.3%
- Private investment - 11%
- Public investment - 4.4%
- Inflation rate - 7%
- Fiscal deficits as GDP - 4.2%

Bhutan SMF Key Findings

MDG simulation (compared to BAU simulation) shows that

- Investment in MDG oriented sectors in the level of \$2.6 billion in 2005 prices and \$3.6 billion in current prices during 2006-2015 might leads to
 - Acceleration in GDP growth by about 1% points
 - Acceleration in public investment growth by 2.4 % points
 - Acceleration in private investment growth by 0.4 % points (crowding-in effect)
 - Widen the fiscal deficits by 5-6% more (with same level of grants) with little impact on the inflation rate

Lessons learnt

- Data problems require that the model needs to be simple
- Robust parameters needed for generating MDG consistent macroeconomic framework
- RCC modelling works in Bhutan, Mongolia and Sri Lanka confirm that a variety of approaches are needed for MDG based plans
- RCC model has been designed to keep it a flexible platform, so that it could be used for (i) MDGs analysis, (ii) medium/short-term planning and budget formulation and (iii) analysis of growth, fiscal space, and emerging issues

Agenda for further support to Bhutan

- Providing technical input to MTRF process by adding a few more equations in the model to capture balance of payments and disaggregation of real sector
- Extending SMF to encompass poverty and income distribution outcomes of MDG/TFYP investment.
- Imparting another round of training to core staff working on planning and budgetary framework

Agenda for Future work at regional level

- **Improving modelling**
 - Strengthening social/MDG module
 - Adding more modules (gender, environment, and energy)
 - Linking with households surveys to account for poverty and inequality impact
 - Explore sectoral or satellite modelling approach
- **More disaggregated modelling particularly in real sector**