Plenary Session IIIa:
The General Dataset of MAMS

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Outline

- Introduction: MAMS as a Standard Model
- General Dataset for Building a Baseline
  - highlighting key data

Introduction

- MAMS is written as a "standard" (flexible structural) model – similar to the IFPRI Standard Model.

- The objective is to make model-based analysis more efficient

  – better quality

  – less demanding in terms of time and skills

MAMS as a Standard Model

- Separation between model code and database
  - a generic set of model files in GAMS
  - application-specific files in Excel for data and simulations
  - anything that is not specific to a database should appear in the model code
    - if you want to correct an error, you only need to do it once

MAMS as a Standard Model – cont.

- Model code is written to capture what is found in each database
  - flexible (dis)aggregation
  - alternatives specified for selected assumptions
    - macro closures
    - presence/absence of unemployment
    - presence/absence of regulated sectors
    - other features

MAMS as a Standard Model – cont.

- Model code includes:
  - aggregation code
  - SAM balancing program -- to remove minor imbalances exceeding some small cut-off
  - error diagnostics -- pinpointing errors in the database and simulations
  - pre-programmed reports of simulation results

MAMS File Structure

- ## MAMS data files
  - general data (SAM, standard CGE elasticities, base-year unemployment, other)
  - MDG data
  - simulations data

- ## MAMS GAMS files
  - calibration and base run
  - simulations
  - reports
  - macro reports in Excel
  - meso reports in Excel

Two Key Excel Files for Base Run

- For core version
  - test-data-general.xls
  - (copied and renamed to <app>-data-general.xls) – the focus of this presentation
  - allows to solve MAMS without the MDG module
- For MDG version
  - test-data-mdg.xls
    - (test-data-general.xls also needed)
  - (copied and renamed to <app>-data-mdg.xls)
  - enables computation of MDG indicators and targets
- Now, open the file
  - <app>-data-general.xls

General Features

- Coloring scheme for worksheet tabs
  - green: input is required
  - yellow: input is optional
  - red: not for input
- Worksheet names
  - if data for only one item (set or parameter), worksheet is named after this item
  - if data for multiple items, worksheet name reflects that general content
- The required or suggested units are indicated; for 3% type 0.03, not 3

Warning!

- The numbers in test-data-general.xls and test-data-mdg.xls do not correspond to any country
  - they have been entered only to calibrate a trial version of MAMS
  - country teams should work with country-specific data sets
- The numbers in yem-data-general.xls and yem-data-mdg.xls correspond to a Yemeni dataset.

Sets and Mappings

- The file is divided into a large number of worksheets, most of which permit the user to define values for parameters used in MAMS.

- SETS
  - time related sets
  - a global set
  - SAM related sets

Sets and Mappings – cont.

- ## The global set
  - all accounts in the SAM
  - each government capital stock – these are not included in the SAM unless value added is attributed to them
  - any additional items generated via aggregation
  - other elements automatically added by the model code

Sets and Mappings – cont.

- Some mappings (i.e., relationships between sets) can not be inferred from the SAM
  - between accounts for capital stocks and related investment accounts
    - worksheet **mfcapinv**
  - between activities and investment – only for government
    - worksheet **mactinv**

Yemeni SAM for MAMS: Data Sources

- Main source of information is I/O tables 2004
  - production, intermediate consumption, final demand, exports, imports, indirect taxes, and value added
- Balance of payments
  - external account of the SAM
- Bulleting of Government Finance Statistics 2008, data for 2004
  - government current account
- Household Budget Survey 2005

Steps in the SAM Building Process

1. Construction of a Macro SAM.

2. Disaggregation of the Macro SAM into a matrix with a large sectoral breakdown (Micro SAM).

3. Adaptation of the Micro SAM to make it suitable for the calibration of MAMS.

Accounts in the Yemeni SAM

Sectors (25)	Factors of production (13)	Savings accounts (3)
Private (17)	Unskilled labor	Hoseholds
Agriculture	Semi-skilled labor	Government
Crude oil, gas, other mining	Skilled labor	Rest of the world
Food and beverages	Private capital	
Textil	Natural resource	**Capital accounts (3)**
Wood, paper and press	Government capital (8)	Hoseholds
Liquid petroleum products		Government
Chemical products	**Institutions (3)**	Rest of the world
Non-metal industry	Hoseholds	
Metal and equipment	Government	**Investment accounts (9)**
Other manufactures	Rest of the world	*Private (2)*
Construction		Gross capital formation
Other services	**Tax accounts (4)**	Stock changes
Health Private	Commodity taxes	*Government (8)*
Primary education g1-g6	Factor taxes	Water and sanitation
Primary education g7-g9	Direct taxes	Other infrastructure
Secondary education	Import taxes	Health government
Tertiary education		Primary education g1-g6
Government (8)	**Interest payments (3)**	Primary education g7-g9
Water and sanitation	Domestic interest payments	Secondary education
Other infrastructure	Foreign interest payments	Tertiary education
Health government		Other government
Primary education g1-g6		
Primary education g7-g9		
Secondary education		
Tertiary education		
Other government		

Accounts in the Test SAM

Sectors (22)	Factors of production (17)	Tax accounts

Sectors (22)

Private (12)
- Agriculture
- Natural-resource-based export
- Industry
- Private services
- Health - non-gov
- Health - low tech - non-gov
- Health - medium tech - non-gov
- Health - high tech - non-gov
- Education - primary 1 - non-gov
- Education - primary 2 - non-gov
- Education - secondary - non-gov
- Education - tertiary - non-gov
- Water and sanitation - regulated

Government (10)
- Education - primary 1 -- gov
- Education - primary 2 -- gov
- Education - secondary -- gov
- Education - tertiary -- gov
- Health - gov
- Health - low tech - gov
- Health - medium tech - gov
- Health - high tech - gov
- Other infrastructure
- Other government

Factors of production (17)
- Labor - < completed sec edu
- Labor - completed sec edu
- Labor - completed ter educ
- Private capital
- Capital for a-edup1
- Capital for a-edup2
- Capital for a-edus
- Capital for a-edut
- Capital for a-hlthg
- Capital for a-hlt1g
- Capital for a-hlt2g
- Capital for a-hlt3g
- Capital for a-wtsn
- Capital for a-oinf
- Capital for a-ogov
- Land
- Natural resource

Institutions (6)
- Household - rural - 1 (rich)
- Household - rural - 2 (poor)
- Household - urban
- Non-government organization
- Government
- Rest of world

Tax accounts
- Direct taxes
- Import taxes
- Export taxes
- Other indirect taxes

Investment accounts (13)
- Investment private activities
- Investment a-edup1
- Investment a-edup2
- Investment a-edus
- Investment a-edut
- Investment a-hlthg
- Investment a-hlt1g
- Investment a-hlt2g
- Investment a-hlt3g
- Investment a-wtsn
- Investment a-oinf
- Investment a-ogov
- Stock change

Transaction costs (3)
- for exports
- for imports
- for dom output sold dom

SAM and Growth Rates

- SAM -- provides the bulk of the data used to define base-year parameter values.
- Miscellaneous data essentially easy to compile based on observed trends – national accounts and government accounts
  - economy-wide growth rate
    - worsheets **ewidedata** and **gdpgrw**
  - government consumption growth rate by commodity
    - worsheet **govcongrw** (relevant if govrulespnd=1)
  - foreign borrowing growth rate by institution
    - worksheet **fborgrw** (relevant if govrulerec0('fborgov',t1)=1)
  - government domestic borrowing growth rate
    - worksheet **gborgrw** (relevant if govrulere0('gborz',t1)=1)

Growth Rates – cont.

- Miscellaneous data essentially easy to compile based on observed trends – cont.
  - growth for transfers between institutions
    - worksheet **trgrw**
  - growth for world prices – exports and imports
    - worksheet **pwegrw** and **pwmgrw**
  - growth for foreign direct investment
    - worksheet miscdata('fdigrw') (relevant if **macrorule0**('fdiz',t1)=1)

Important!

- The data in **ewidata**(ac) applies across elements in some category
  - for example, all activities a
- The user, in some other sheet, can provide more disaggregated information that overwrites the information provided here; for example,
  - the scalar growth rate for TFP – ewidedata('tfpexoggrw') – is applied to all elements in the activity set a
  - in a separate worksheet -- tfpexoggrw, the user can introduce information disaggregated by activity a, which, if values are non-zero, would overwrite the value for ewidedata('tfpexoggrw')
- Suggestion: when developing a new dataset start by providing data in ewidata only; then, in a second stage, provide additional information in other sheets to overwrite as you see fit.

Population

- Population data (worksheet **pop0**) – also generally easy to compile; from UN population statistics
  - population by household group (row hhd)
  - population in age cohort that
    - (1) enters grade 1 (row ageg1)
    - (2) enters the labor force, often 15 years old (row agelabent)
  - population in labor force age (usually, 15-64) (agelab)

Productive Factors

- Factor data – also generally easy to compile, especially if hhd survey data is available
  - base-year employment by labor category and activity
    - worksheet **qfbase0**
  - labor force participation rate
    - worksheet **labpartrat0**
  - unemployment rate by labor category
    - worksheets **uerat00** and **ueratmin**
  - labor market related elasticities -- more difficult to compile
    - worksheet **wfreselas**

Productive Factors – cont.

- The elasticity of reservation wage by labor category w.r.t.
    - household per capita consumption
    - employment rate (i.e., 1-unemployment rate)
        - similar to a wage curve
    - average price of value-added
    - CPI

Private Capital Stocks

- In a dynamic model, private and public capital stocks need to be estimated.
- For private, computed based on net profit rate
  - worksheet **miscdata** column **netprfrat**
  - worksheet **deprcap** row f-capprv

$$qfbase_{fcap,'total'} = \frac{\displaystyle\sum_a SAM_{fcap,a}}{netprfrat_{fcap} + depr00_{fcap}}$$

Government Capital Stocks

- For government, historical government investment data is used to estimate base-year capital stocks, by government activity
  - this data is complemented with data on depreciation rates and government consumption

Government Capital Stocks – cont.

- MAMS computes government capital stocks that usually are not in SAM
  - capital is needed for public provision of MDG commodities – in fact, government invest in MDG commodities (edu, health, wtsn)
- Typically, the government does not receive capital income from the provision of public (free) primary education.
- On the other hand, the government can receive capital income from the provision of private goods; for example, oil.

Government Capital Stocks – cont.

- In MAMS, initial government capital stocks are computed based on the relationship between expansion of government consumption (service provision) and past investments. See worksheets
  - **deprcap**
    - depreciation rate for capital factor f in t1 (from literature review: 4.5% private and 2% public)
  - **govinv0**
    - historical government investment data at base-year prices in same unit as SAM -- although the data entered is linked to capital factors, it in fact refers to investment
  - **govconrat**
    - = (1 + annual growth rate govcon)^(# of years in govinv0 series)

Estimating Base-Year Government Capital Stocks: A 3 Year Example

Defining capital stock in current and previous years on the basis of data on investment, depreciation rates, and earlier capital stocks.

$$K_t = I_{t-1} + (1-\delta)K_{t-1}$$

$$K_{t-1} = I_{t-2} + (1-\delta)K_{t-2}$$

$$K_{t-2} = I_{t-3} + (1-\delta)K_{t-3}$$

Substituting,

$$K_t = I_{t-1} + (1-\delta)[I_{t-2} + (1-\delta)K_{t-2}]$$

$$K_t = I_{t-1} + (1-\delta)I_{t-2} + (1-\delta)^2[I_{t-3} + (1-\delta)K_{t-3}]$$

$$K_t = I_{t-1} + (1-\delta)I_{t-2} + (1-\delta)^2 I_{t-3} + (1-\delta)^3 K_{t-3} \qquad (1)$$

Estimating Base-Year Government Capital Stocks: A 3 Year Example – cont.

Defining capital stock in current and previous years on the assumption that the capital stock grows at the same rate as consumption,

$$K_t = (1+g)K_{t-1}$$

$$K_{t-1} = (1+g)K_{t-2}$$

$$K_{t-2} = (1+g)K_{t-3}$$

Substituting,

$$K_t = (1+g)(1+g)(1+g)K_{t-3}$$

$$K_t = (1+g)^3 K_{t-3} \tag{2}$$

Estimating Base-Year Government Capital Stocks: A 3 Year Example – cont.

Substituting (2) into (1),

$$(1+g)^3 K_{t-3} = I_{t-1} + (1-\delta)I_{t-2} + (1-\delta)^2 I_{t-3} + (1-\delta)^3 K_{t-3}$$

$$\left[(1+g)^3 + (1-\delta)^3\right]K_{t-3} = I_{t-1} + (1-\delta)I_{t-2} + (1-\delta)^2 I_{t-3}$$

$$K_{t-3} = \frac{I_{t-1} + (1-\delta)I_{t-2} + (1-\delta)^2 I_{t-3}}{\left[(1+g)^3 + (1-\delta)^3\right]}$$

where the term (1-delta)^3 refers to the share of capital stock of first year of historic investment series that remains.

Government Investment Demand

- desired investment =
  - anticipated demand for capital next year (based on current production growth) - remaining capital stock next year if no investment
  - note: the rate of expected output growth can be defined as the rate of simulated output growth during the last 1, 2 or 3 years (worksheet **miscdata**('grwexpeclag')

Government Investment Demand – cont.

$$DKGOV_{fcap,t} = \sum_a ifa_{fcap,a,t} QA_{a,t} \exp\left(\log\left(\frac{QA_{a,t}}{QA_{a,t-1}} \right) \right)$$

$$+ \left(1 + qggrwbar_{c,t} + \sum_c qg01_{c,c',t} QGGRW_{c,t} \right) QFINS_{gov,fcapgovinf,t}$$

$$- QFINS_{gov,fcap,t} \left(1 - depr_{fcap,t} \right)$$

for public infrastructure, actual QG (government service level) is determined by the current capital stock.

Government Investment Demand – cont.

- worksheet **shrdkgov0**(f,t1) = realized share of desired change in gov investment demand (smoothing factor)

$$DKINS_{gov,fcapgov,t} = DKINS_{gov,fcapgov,t-1}$$
$$+ shrdkgov_{fcapgov,t}\left(DKGOV_{fcapgov,t} - DKINS_{gov,fcapgov,t-1}\right)$$

where *DKINS(ins,f,t1)* = (realized) fixed investment in f by institution ins, and *DKGOV(f,t1)* = desired government investment in capital stock f

Productivity Growth

- MAMS allows to model productivity growth
  - exogenously
    - worksheet **tfpexoggrw**
  - endogenously
    - need elasticities of TFP growth by activity w.r.t.
      - government capital stocks (e.g., infrastructure) – worksheets **mtfp** and **mpcapgov**
      - GDP trade share – worksheet **tfpelastrd0**

Special Treatments for Selected Activities

- activities in set anatres(a) = natural-resource-based export activities (one per natural resource factor)
  - worksheet **sam-related-sets** and
  - **qfacgrwrat**
- activities in areg(a) = regulated activities
  - worksheets **sam-related-sets** and
  - **miscdata**('pagrw-areg') = growth rate for output price (PA) in the activity areg
  - **miscdata**('dkgrw-areg') = growth rate for investment in capital stock of the activity areg

Elasticities

- The "usual" CGE elasticities are
  - CES substitution between primary factors of production, by commodity -- **prodelasva**
  - CES substitution between imports and domestic goods, by commodity -- **tradelas**
  - CET transformation between exports and domestic sales, by commodity -- **tradelas**
  - constant price elasticity of demand – large country assumption, by commodity -- **tradelas**
  - expenditure elasticity of market demand by commodity and household – LES -- **leselas**

Closure Rule

- govclos, siclos, rowclos, facclos
  - related to macro closure rule
  - see previous presentation on building a baseline for MAMS